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Kew, ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1898.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 133-134.] JANUARY and FEBRUARY. [1898.

DXCII.—CEARA RUBBER.

(*Manihot Glaziovii*, Muell. Arg.)

The plant yielding what is known in commerce as Ceara rubber or Maniçoba, and shipped from the Brazilian ports of Ceara, Bahia and Pernambuco, was identified at Kew eleven years ago. The following note on the subject appeared in the *Kew Report*, 1877, p. 17 :—

" I mentioned in my last Report that a plant in cultivation in the Botanic Gardens of Regent's Park, London, of Buitenzorg (Java), and of Mauritius, under the name of *Hevea guyanensis* was, in reality, probably *Manihot Glaziovii*, Muell. Arg. I am now able to state that, having received authentic specimens of this species from the Botanic Gardens, Rio Janeiro, it is identical with the cultivated plant mentioned above, and also with that producing the Ceara rubber."

Manihot Glaziovii is a Euphorbiaceous plant which was described by J. Mueller in Martius' *Flora Brasiliensis* (xi., pt. ii., p. 443). Dr. Glaziou (after whom the species is named) sent to Kew specimens from Rio, where he had it under cultivation. A full description, with a plate, from a plant growing in the Ceylon Botanic Gardens, was contributed by the late Dr. Trimen to the *Journal of Botany* (1880, pp. 321–325, t. 215). This plate was reproduced in the *Kew Report* (1880, p. 17).

Manihot Glaziovii is a moderately-sized tree, 30 to 50 feet high, with an erect stem, 8 to 20 inches in diameter, branching di- or trichotomously, the branches ascending and frequently branched in a similar manner, forming a dense rounded crown ; the bark is purple-grey, the thin silvery outer layers readily peeling off transversely in narrow strips. The *leaves* are palmate, deeply cut into three, five or seven oblong-ovate lobes, smooth on both surfaces except for a small tuft of woolly hair at the junction of the petiole, thin in texture and deep bluish-green above, paler beneath. The *flowers* are rather large, completely unisexual

(male and female in the same raceme) from the forks of the younger branches, the male (more numerous) above, the female below, and expanding several days before the male. The *fruit* is a pendulous capsule, about an inch in diameter, nearly globular, dry and hard, when ripe, containing three smooth and polished *seeds*, greyish yellow or brownish, variously mottled and splashed with purplish black. The testa (or coat of the seed) is very hard and thick ; the cotyledons are very thin, foliaceous, slightly cordate at the base ; the endosperm oily but solid.

In the young state *Manihot Glaziovii* somewhat resembles the well-known Cassava or Mandiocca plant (*Manihot utilissima*, Pohl.) and has similar swollen roots. The tree, when fully grown, has a stem resembling a birch, "and the outer bark comes off in the same way in thin silvery peelings."

In 1876 Mr. Cross, who had been engaged on behalf of the Government of India to collect seeds and plants of india-rubber trees in South America, visited the Ceara region on the north east of Brazil, midway between the towns of Para and Bahia. This is outside the great forest region of the Amazon valley, and is known as the *Sertao* or wilderness, extending in a great belt from the Paranahyba river to the São Francisco.

Mr. Cross, in his Report to the India Office in 1877 (p. 14) describes the flat country from Ceara, running back to the mountains, on which the tree abounds, as manifestly possessing "a very dry arid climate for a considerable part of the year. This is evident from the fact that the mandiocca and other crops require to be irrigated. The rainy season is said to begin in November and end in May or June. Torrents of rain are then reported to fall for several days in succession, after which the weather moderates for a brief space. According to some statements there are occasional years in which hardly any rain falls. This assertion concurs with the aspect presented by the country in general. The daily temperature on board the ship ranged from 82° to 85° F., but inland it is often probably 90°. The localities traversed by me nowhere seemed to be elevated more than 200 feet above the sea." At Pacatuba, about 40 miles from Ceara, the actual place where the specimens were obtained, "the general forest was tolerably high, but the sparse, small, foliage did not afford much shade from the fierce rays of the sun. The soil was in places a sort of soft sandstone or gravel which was bound up in the most extraordinary manner. Neither grass nor weeds grew among this underwood, and there was an entire absence of ferns, mosses, and other plants." In another place, somewhat further from the coast, the traveller, shortly after entering the bush-like forest, "came on a large tract of land covered by immense masses of grey granite, some of which might be fifty tons or more in weight. Rounded masses of the same rock also cropped out in many places. . . . . Many good-sized rubber trees were growing in the spaces between these granite masses. . . . The situation was very dry, but no doubt some seedlings had sprung up, which, owing to numerous thickets of shrubs, were not perceived."

Cross obtained at Maracanahu, 30 miles inland from the town of Ceara, lat. 4° S., 60 plants and 700 seeds. (*Report*, pp. 12–14.)

Of these, 42 plants and the seeds were safely deposited at Kew on the 23rd November 1876. The following note appeared in the *Kew Report* (1877, p. 16) :—

"As stated in my last year's Report, we obtained from the seeds and stems of the Ceara rubber brought to this country by Mr. Cross a stock of 55 plants with which to commence propagation. On June 11th four plants were sent to Singapore, and on September 15th, at which date our stock had increased to 300 plants of all sizes, 50 were sent to Dr. King at Calcutta, and 50 to Dr. Thwaites in Ceylon, all the stems collected by Mr. Cross being divided amongst these two recipients. At the end of the year our stock amounted to 448 plants."

The further steps taken to distribute plants of the Ceara rubber are given in the *Kew Report* for 1878 (p. 15) as follows :—

"At the end of August of last year consignments of plants of the Ceara rubber, consisting, in each instance, of two wardian cases containing 80 plants, and one dry box containing 40 plants were sent to Lieut.-Colonel Beddome, Conservator of Forests, Madras, and Dr. King, of the Royal Botanic Gardens, Calcutta. Of those sent to Madras all were alive on arrival in the wardian cases, while of the contents of the dry box about half were saved. Those originally sent to Dr. King (*see Kew Report* for 1877, p. 16) arrived in rather bad condition. Few were saved, and the growth of these did not impress Dr. King favourably. 'They all look more or less weak and lanky, as if the climate were too damp for them.' This was, perhaps, a premature judgment from want of familiarity with the habit of the plant. Dr. King now writes :— 'Ceara rubber is going to be a success here.'"

"At Ceylon, in April, one of the plants first sent out had already made an attempt to flower, and by the end of the year Dr. Thwaites was distributing copious supplies of seed to Calcutta, Burmah, Madras, and Singapore (where, however, it seems unable to stand the wet season)."

"I regard, therefore, the work of Kew completed as regards the Ceara rubber. Living plants of it have been distributed during the past year to Dominica, Fiji, Jamaica, Java, Sydney, Trinidad, Queensland and Zanzibar."

Of Ceara rubber there are imported into this country about 200 to 300 tons per annum. There are three grades found in commerce, varying according to the mode of tapping the trees and the care taken in the preparation. When pure it is regarded as almost next to Para in value. It is a "dry" rubber, very elastic and free from stickiness. It is, however, mixed with wood and foreign matter, causing a loss to the manufacturer amounting sometimes to 25 per cent. It would appear that the Ceara rubber industry is not extending in South America, for "every year there is an extensive migration of Ceara people to Para bound for the forests of the Amazon." (*Kew Bulletin*, 1892, p. 69.) In case 96, Museum No. I, samples are exhibited from Brazil, and also from plants grown in India, Ceylon, Natal, and Zanzibar. It may be mentioned that the rubber produced under cultivation in Ceylon has been singularly pure and free from impurities. In 1883, according to Dr. Trimen, "as much as 4*s*. per pound had been obtained for Ceylon Ceara rubber."

System of collecting the rubber.—According to Cross (*Report*, p. 14) "this is an operation of a very simple description. On commencing work, the collector takes with him a stout knife and a handful of twigs to serve as a broom. Arriving at a tree, any loose stones or dust are swept from the ground around the base, and some large leaves are laid down to receive the droppings of milk which trickle down. Some do not go to the trouble of sweeping the ground or laying down leaves, for which reason the milk adheres to sand, dust, decayed leaves, and other impurities. The outer surface of the bark of the trunk is pared or sliced off to a height of four or five feet. The milk then exudes and runs down in many tortuous courses, some of it ultimately falling on the ground. After several days the juice becomes dry and solid, and is then pulled off in strings and rolled up in balls or put into bags in loose masses. Only a thin paring should be taken off, just deep enough to reach the milk vessels; but this is not always attended to. Nearly every tree has been cut through the bark, and a slice taken off the wood. Decay then proceeds rapidly, and many of the trunks are hollow. In this condition the trees must yield far less milk, and many no doubt are broken over by the wind or wither away. Collecting is carried on during the dry season only, when rain seldom falls."

Germination of Seed.—The following is taken from *Notes on some Trees yielding India-rubber* (p. 4), by the late Dr. Trimen (Ceylon, Sessional Paper, vii., 1880):—"The seed coat is of remarkable thickness and very hard, and the natural process of germination occupies a long period—it is said more than a year. All that is necessary to hasten this, if desired, is to assist the seed coat in splitting. This is best effected by holding the seed firmly, and rasping off with a file both edges at the radicular end. It is best not to file off the actual end, as it may thus easily happen that the radicle of the embryo may be injured. After this treatment, properly performed, the young plant appears above ground in two or three weeks. The seedlings require no particular attention. They grow rapidly and may be finally planted out at distances of twenty feet. A peculiarity which they share with their close relative the mandiocca is the possession of large tubers on the spreading roots. The trees at Peradeniya, from which seed has been distributed to Burma, India, Jamaica, &c., flowered at the age of eighteen months, and at the present time (at 2½ years) the larger ones form branching trees about 25 or 30 feet high, with a stem 1 foot 9 inches in circumference at a yard from the base, and a smooth, silvery, birch-like bark readily peeling off; being about half the size of those which Mr. Cross describes, and which may be assumed to have been fully grown."

Propagation and Planting.—Mr. Cross (p. 14) suggests "the formation of plantations by cuttings, which will take root as easily as a willow. These should be taken from the points of strong shoots and may be one foot in length. In planting, each cutting may be put down in the soil to a depth of six inches. If scarce, the entire shoot may be cut into pieces, each possessing a bud, all of which will grow if covered with half-an-inch or so of soil. On loose sandy soils or exhausted coffee land, plantations

may be formed at little expense. Hard dry gravelly wastes, if found to support any kind of bush, are also suitable sites. Holes might be made in strong land with an iron jumper and a stout cutting put into each and filled with pebbles. On bare or thinly covered portions of rock the cuttings might be laid down flat, and a little heap of stones or any kind of *débris*, about the size of a molehill, piled over each, care being taken that the extreme point of each cutting with a bud is left uncovered. I do not advocate planting in an entirely barren desert, but wherever there is any sort of stunted tree or scrub vegetation, with an occasional sprinkling from a monsoon shower, the tree is likely to prosper."

Dr. Trimen adds (l. c. p. 4) :—

"Experience of the plant in the botanic garden here has proved the general accuracy of the above remarks. There can be no doubt of the hardiness of the species, its readiness of culture, and adaptability to circumstances. It grows equally readily from seed or from cuttings, and, though a native of a tropical sea-level, thrives well here in Ceylon up to at least a level of 3,000 feet, and on the most barren soils. It has succeeded equally in Calcutta and Madras, but the wet season seems to have killed it at Singapore. It would seem especially adapted for the dry and barren districts of our eastern and northern provinces, or in the higher districts, but it would not be wise to risk it in localities where the temperature is liable to fall below 60° F."

In the following notes the results are given of the results of the attempts to establish the Ceara rubber tree in our various colonies and possessions.

Ceylon.

The cultivation of the Ceara rubber tree was carried on with considerable energy in Ceylon for many years. Numerous experiments were made to find out the best means for tapping the trees and producing the rubber in commercial quantities.

In the *Kew Report* for 1880 (pp. 17–18) the following information is given on the authority of Dr. Trimen :—

"Of the three species of South American trees here in cultivation (the successful introduction of which was due to Kew. See *Kew Reports*, 1876, pp. 8, 9 ; 1877, pp. 15–17), *Manihot Glaziovii* is still the only one which has flowered. Seed of this has been supplied during the year to the Government gardens in India (Calcutta, Saharunpore, Ootacamund) and distributed as widely as possible among the planters in the colony, 24,550 seeds having been thus disposed of, as well as 1879 rooted cuttings. We have also sent small quantities to the Botanic Gardens of Singapore, Mauritius, Jamaica, British Guiana, and Kew, the Acclimatization Society of Queensland, and Mr. Low, Her Britannic Majesty's Resident in Perak."

Dr. Trimen adds :—"This plant is now flourishing in Ceylon in suitable places and proves very hardy ; in the new estates in the Trincomalee district it is reported to be thriving, but to have shown itself intolerant of wet."

Dr. Trimen wrote in his *Report* for 1883 (p. 13) :—"A planted area of 977 acres is credited to this cultivation, but rubber has

not yet appeared among our exports. Since it has been ascertained that the quality is excellent, cultivators have been endeavouring to discover a means by which the milk can be obtained at a cost sufficiently low to give a return, but without, as yet, encouraging results. The removal of the outer separable bark has been objected to on the ground that the bark formed in its stead is of a different character, very hard and inseparable from the green layer a second time. Instruments have therefore been devised for bleeding without such removal. A knife with two parallel blades, which took out a strip of bark, has been modified into one in which the very sharp cutting edges meet to form a V, the basal angle during use being at the cambium. Another invention avoids all cutting, being a double spur-like wheel with sharp but guarded points, which puncture the bark without further injury. The milking (one can scarcely call it tapping) has also been practised on trees of various ages and at different intervals and seasons. While it is found that the yield of individual trees varies extremely, none of the experimenters is satisfied that the small quantity obtainable by present methods is sufficient to make the cultivation profitable at the existing price of rubber. Mr. Wall, however, who states that hundreds of young trees have been bled daily with the 'pricker' for some weeks, and that thus a cooly can collect about half a pound of dry rubber per diem, thinks that, if trees will bear this treatment for 240 days in the year, the cultivation would be remunerative. It appears evident that milking must be repeated at frequent intervals, and (as often already pointed out) the cultivation be conducted on a large scale. Much of the 35,000 acres in private hands in Ceylon, at present growing nothing but *Lantana* and other weeds, is suitable for this hardy plant, which costs nothing to cultivate, affords a substance of a value which is continually increasing, and awaits only the discovery of a process by which the latter can be cheaply and exhaustively extracted."

In the *Tropical Agriculturist* for March, 1887, Mr. W. B. Lamont furnished the following results of experiments carried on by him in the districts of Heneratgoda and Mirigama. These may be regarded as the most favourable obtained in the island :—
" Having reared about 100 plants of Ceara rubber up to their fifth year, and having given a good deal of attention to them, I have arrived, through a long course of experiments, at the following practical results :—No satisfactory result will follow any attempt to obtain produce before the tree is at least four years old ; no system of cutting or piercing the bark will give a satisfactory yield : and it is only in the dry season, when the tree is leafless, and the growth at a standstill, that a satisfactory result can be obtained in the way of harvesting. The plan of obtaining the rubber that my experiments led up to was, as soon as the leaves begin to fall, to remove the outer bark in vertical strips of not more than two inches wide, and not less than four inches apart. The tender inner bark thus exposed to the sun breaks out in something like running sores, from which the rubber slowly exudes and drips on the surface as fast as discharged. In this process the strip of exposed bark is destroyed, but a vigorous tree will close in the bared part in the course of the year, if the width is not more than two inches Ceara rubber, planted at 100 trees

per acre will, after the second year, require hardly any expense in cultivation. As for harvesting, I collected 30 lbs. last January and February by one boy at 15 cents. a day, or say 23 cents. per lb., the local value being about 80 cents. Supposing each tree gave an average yield of 1 lb. per annum, and allowing 30 cents. for cultivation and collecting, 50 cents. would remain as profit, or R50 per acre. It is well to have the plant in the island, but it is not likely to be largely planted so long as there are other products that pay better, or that are better understood, but a time may come when it will *kep a strait.*"

In his *Report* for 1890, Dr. Trimen states :—"Interest in Ceara rubber has of late years very much died away, the yield of rubber having been found too small to satisfy the planter's expectations. Thus I have made no report on it since 1884. There are, however, considerable plantations on some estates, and now that the trees are older it is found to be profitable to harvest the product. Several shipments have been made to London during the past year, and have realised very good prices. Of course the quantities have not been large. One shipment of 4 cwt. fetched 1*s.* 8½*d.* to 1*s.* 9½*d.* per lb. net, showing a profit here of about 37 cents. (of a rupee) per lb. A planter estimates the cost of collection at about 36 cents. per lb., and reckons that trees of eight years old afford at least 3 ozs., whilst some ten years old gave half a pound. The collection is done in a somewhat primitive way during the dry season, January to March. After the outer flaky layers of bark have been peeled off, the inner bark is pricked copiously ; the tears of rubber which exude are allowed to dry on the tree, and are picked off, the resulting product being quite like 'Ceara scrap' of commerce, but in small tears."

"The present opinion of planters seems to be that this kind of rubber pays to harvest, but not to cultivate, and they are prepared to destroy their trees to get the crop. But, even on such a system (which has been largely followed here with cinchona), extensive areas of bad soil could surely be profitably occupied with this tree, so grown as to provide a crop annually ready for tapping."

A review of the position in 1893 is given by the *India-Rubber, Gutta Percha and Electrical Trades Journal* of June 8 of that year :—"A few years ago great hopes were entertained in Ceylon as to rubber culture. We regret that the spirited efforts made by many planters have not hitherto been so remunerative as was expected. A fresh instance is just to hand, as the *Tropical Agriculturist* for May, 1893, regrets to learn from Mr. Vollar that his rubber cultivation in Dumbara is not likely to be permanent. The Cearas were originally planted for shade trees for the cacao, but they have not proved very suitable for this purpose, and will probably have to be cut down. Meantime, perhaps 5,000 lbs. of rubber will be collected on Pallakelle this season ; a cooly, by beginning the tapping early in the morning, usually gets 3 lbs. of rubber in the liquid or soft state, which hardens and dries down to perhaps to half that weight. There is no fortune to be made out of this (says our contemporary), considering how long the rubber trees have to grow before yielding an appreciable quantity of milk. Of course, it is the time of waiting, during which so

much capital lies idle, that is the great difficulty in the matter. Still, we cannot bring ourselves to think that Ceylon has done with rubber culture. If the climate suits the plant, we believe that colonial energy and enterprise will eventually find out the way to overcome all hindrances."

Dr. Trimen, in his *Report* for 1893 (p. 13), remarks :—"Ceara rubber has not taken any hold on planters here as a permanent cultivation ; yet it might, I think, be worked at a profit by a system of annual planting, and the sacrifice of successive crops of trees when they reach ten or twelve years. About 1½ lbs. of dry rubber is at that age obtained from each tree."

The subject is not further touched upon in the Reports of the Ceylon Botanic Gardens. The whole interest in regard to rubber in that island has now been transferred to the cultivation of the Para Rubber tree (*Hevea brasiliensis*).

MADRAS.

The Director stated in the *Kew Report* for 1880 (p. 17) :—"In the Nilgiris, I am informed, Ceara rubber is doing well at 2400 feet."

The following is the most recent information (*Annual Report of the Forest Department, Madras Presidency*, 1895–96, pp. 29–30) :—

"In Ganjám an area of 3 acres in Napier's Park at Chatrapur was planted with india-rubber seedlings and they are doing well, their height ranging from 4 to 9 feet. The sowing of rubber seed in Gódávari was unsuccessful.

"In South Arcot there were at the close of the year 410 trees, including the self-sown seedlings (295) during the year.

"In North Malabar, the sample rubber sent to Kew last year was reported on by the Director, Royal Garden, as follows :—

'First sample.—Well cured, but cuts very wet ; value 1*s.* 6*d.* to 1*s.* 8*d.* per lb. [This sample is in Case 96, Museum No. 1, at Kew.]

'Second sample.—Well cured, dry, rather barky ; value 1*s.* 9*d.* to 2*s.* per lb.'

"It is proposed to tap the trees after the rains in order to obtain statistics as to the average yield in rubber. The trees grow luxuriantly and reproduce themselves very freely.

"In South Malabar, the Ceara rubber trees are flourishing. It reproduces itself everywhere in Nilambúr. Experimental tapping was made in April, but as the plants were then leafless they did not bleed freely and no rubber was therefore collected. They will again be tapped in 1896–97."

MYSORE.

The results of experiments with Ceara rubber plants in Mysore are summed up by Mr. J. Cameron, F.L.S., in his *Report on the Lal Bagh Gardens*, dated April 12, 1886 :—

"Further experience has justified my opinion that the Ceara rubber tree is adapted to the climate. Its cultivation progresses so favourably that every encouragement is offered to plant on an extensive scale. The tree loses its leaves during the driest period

of the year, and is thus preserved in a semi-dormant state until the vernal showers excite growth again. Irrespective of their commercial value, deciduous trees of this class are much needed, and in the rocky maidan regions of Southern India would be invaluable. Judging from our own experience, the Ceara rubber tree requires no pampered treatment, although, like most plants, it prefers a little kindness to starvation and utter neglect. It grows very rapidly in vegetable mould, but planted in any ordinary soil, at the break of the South-West Monsoon, the seedling will shift for itself and possibly have taken such a hold on the ground that no artificial watering is required during the subsequent dry season. This is what I have done with a hundred seedlings six months old, on poor gravelly soil, and I am certain that nearly the whole will burst forth into fresh growth when the rains set in. At present they look like so many dead canes. In open land the tree will attain an average height of 30 to 35 feet, with a diameter, through the branches, of 15 to 20 feet. Seedlings might therefore be planted uniformly at 18 feet apart each way. The latter are ready for the field when six months old and about 15 inches high, with a woody base."

The Report of the following year contains further information as under :—

"A ball of Ceara rubber, weighing 6 ozs., has been collected from one or two trees in the garden (chiefly one tree which was growing by a channel and had not lost its leaves, as the trees invariably do in dry ground during the months of March and April). But it was evidently too late in the season, as the milky juice will not run freely when the trees are wintering. I therefore regret that tapping must be postponed again. We have collected 17 lbs. of Ceara seeds for propagation."

Burma.

Colonel E. S. Berkeley, Rangoon, reported in 1884 that "The plants of *Manihot Glaziovii* received from Dr. King in 1879 are growing into robust trees. The climate of Burma seems to suit this plant; it seeds freely."

Straits Settlements.

Ceara rubber trees were introduced into the Malay Archipelago in 1879, but owing possibly to the excessively damp climate they do not appear to have succeeded anywhere. Mr. H. N. Ridley, F.L.S., regards *Manihot Glaziovii* as quite unsuited for remunerative cultivation in Singapore, and a similar opinion is expressed in regard to the prospects in the Native States. It is possible, as in Ceylon, that the best rubber plant for regular cultivation in Malaya is the Para rubber tree (*Hevea brasiliensis*).

Mauritius.

The following interesting particulars respecting the propagation of Ceara rubber trees in Mauritius in 1883 were communicated by the late Mr. Scott :—

"Of all the places where the Ceara rubber trees have been planted they appear to thrive better and grow more vigorously at

the Gardens, Pamplemousses, than in any other locality. An experiment was made when the trees of three years' growth shed their leaves in transplanting them. These were lifted carefully, but without balls of earth attached to the roots, and planted in another part of the plantation; these transplants all held, and although they have not made such a strong growth as the other trees, it proves that this tree can be transplanted with impunity."

Further, Mr. Scott states :—

"During the season when the Ceara rubber trees were at rest, they were cut back to about three feet from the ground, and the stems, some of which were 8 feet long, cut into lengths of 6 inches and tied up in grass-enveloped balls of earth, and arranged in beds under shade until they had formed rootlets and thrown up a stem of about four inches high, when they were planted out where it is intended they should grow permanently. By this method 5,800 cuttings were propagated, these were then divided amongst the plantations in the lower parts of the island."

SEYCHELLES.

Mr. E. H. Edwards wrote on the 1st July, 1885 :—

"Ceara rubber I pronounce a great success, both cuttings and plants raised from seed grow rapidly: it is too early yet to give any opinion as to the yield, but, if growth of wood be any criterion, in the not distant future Mahé should be a rubber producing country."

ZANZIBAR.

The following extract is taken from a *Report* on the cultivation of Ceara rubber trees in Zanzibar by Sir John Kirk, dated December 19th, 1883 (*F.O. Reports. Commercial*, No. 11, 1885, pp. 38, 39) :—

"Five years ago I received from the Director of the Royal Gardens, Kew, in exchange for plants of our African india-rubbers of the genus *Landolphia*, other sorts of india-rubber giving plants, among which was the Ceara rubber, *Manihot Glaziovii*.

"This I find grows here with the greatest rapidity and propagates itself freely in the worst soil. It is only now, however, I have been able to obtain a sample of the india-rubber likely to be produced, and on which the value of the new introduction entirely depends. I find that trees only begin to yield when five years old, and no doubt these are even then too small to be remunerative.

"I have collected a sample of the produce, which I forward by this mail, and which I would ask your Lordship to be good enough to forward to Sir Joseph Hooker at Kew to be reported on. If the quality of this india-rubber is found to be good, I can then confidently encourage the Sultan to plant widely the new tree in the unoccupied parts of this island. It stands the climate, grows freely, needs no care, and would be a source of income on which his people might fall back in the event of other crops failing.

"The sample sent includes two qualities—that picked from the trunk of the tree, which, of course, is the best, and that fallen on the ground, and so become mixed with sand."

The Report on the samples of Ceara rubber from Zanzibar by the India Rubber and Gutta Percha and Telegraph Works Company, Limited, dated the 7th February, 1884, was as follows :—

"The appearance and general physical properties of this rubber would lead to the opinion of its being derived from the same source as the ordinary Ceara rubber: but the statement in Sir John Kirk's letter above referred to 'that trees only begin to yield when five years old, and no doubt these are even then too small to be remunerative,' is conflicting.

"The quantity of ash obtained from the sample collected from the trunk of the tree amounts to 3·64 per cent., which, together with its composition, are strongly corroborative of its being obtained from the Ceara plant.

"Of the two samples of this rubber which have been received, the one which had fallen on the ground, and had become mixed with sand, was so deteriorated and decayed as to require no further consideration from a manufacturer's point of view.

"The sample collected from the trunk of the tree had such a promising appearance that its unfavourable behaviour under the vulcanizing process was somewhat disappointing ; the quantity available for experiment was too small to determine the cause of its becoming spongy and porous.

"Its loss on drying and washing was 23·46 per cent. ; this shows that the rubber contains a large amount of soluble matter. Ceara rubber under cultivation in Ceylon gave only a loss of about 7 per cent. under similar circumstances, but obtained from plants about two years old.

"It is by no means improbable that the collection of samples from younger plants may lead to more favourable results.

"The india-rubber collected from the trunk of the tree would be at the present time commercially worth about 1*s.* 9*d.* to 2*s.* per lb. The sample collected from the ground we can put no value to."

Sir John Kirk wrote (Dec. 16th, 1885) as follows in regard to the above Report :—

"As to the Ceara rubber reported on, which proves so unsatisfactory when worked, it is certainly the product of trees I first received from you as *Manihot Glaziovii.* I am quite satisfied the tree is *here* of no use to a private planter. Some trees yield a watery juice with almost no rubber, and at best the amount is small. I have, however, had the seed widely scattered on the mainland over 300 miles of coast, and as it seems to grow so well and propagate so freely, it may be a resource to the natives, and repay them the trouble. Perhaps inland, in less moist climates, the produce may be better, but I have condemned the tree as useless to a European planter, and a troublesome weed where once introduced into a plantation."

NATAL.

The *Kew Report* for 1880 (p. 18) records :—

"Mr. Keit, the Curator of the Botanic Garden, reports that the Ceara rubber plants raised from seed obtained from Ceylon in 1878 have grown luxuriantly, and had flowered, but had not

had time at the date of his last report (December 31, 1880) to perfect their seeds."

The climate and soil in 1884 were found well suited to the growth of the plants, little progress has, however, been made in extending the cultivation. Mr. Wood, the Curator of the Botanic Garden, Durban, reported, 1885 :—

"The plant, which yields 'Ceara scrap,' is considered to be one of the most valuable of the rubber-yielding plants, and was introduced into these gardens from Kew, in 1878, but all attempts to propagate it were unsuccessful. In consequence, however, of further information received by me from abroad, another trial was made, and about 25 plants were reared and planted out in the garden, and thus a small beginning has been made, to test whether or not the cultivation of this plant may be successfully carried out in the Colony. The present appearance and condition of our plants, shows unmistakably that the climate and soil of our garden is well suited to its growth. More plants will be ready for next spring, as we shall go on propagating them as quickly as possible for distribution."

West Africa.

As might be expected the humid climate in the lowlands in West Africa has not been favourable to the production of Ceara rubber. An exception must, however, be made in the case of the Gambia which possesses, on the whole, a drier climate with a light sandy soil. The Administrator in 1888 (*Kew Bulletin*, 1889, p. 144) stated that plants sent out from Kew thrive "vigorously in the soil of the Gambia, and their introduction here cannot fail to be of immense advantage to the settlement. I have transplanted several young trees in the spaces now made available for experiments of this nature, and have no doubt that they will be successfully established."

Jamaica.

The *Kew Report* for 1880 (p. 17), gave the following particulars, supplied by Mr. Morris :—

"This plant is evidently very hardy, and adapts itself readily to the exigencies of culture. Plants at Castleton (600 feet) and at the Parade Garden, Kingston (50 feet) are doing well. At the former gardens, young trees when about 9 to 12 feet high were beginning to flower, but the hurricane deprived us of the hope of procuring seed this year. Judging by reports from South America it is possible that tracts of dry, stony, almost worthless lands, in the plains may be turned to good account by means of this cultivation."

The *Report of the Botanical Department* for 1884, states :— "Of the Ceara rubber there are seven large trees at the Castleton Gardens; the largest is about 25 feet in height, with a circumference of 28 inches about one foot from the ground. It appears to be more at home than any of the other species of rubber-yielding plants at Castleton."

"Being anxious to obtain a small specimen of Ceara rubber the trees at Castleton were tapped early in September. Although the trees are strong and healthy the flow of milk was certainly very small. When the trees were tapped they were bearing a heavy crop of both flowers and fruit. It is intended to try them again later."

The *Report* for 1886 states further:—"The trees of Ceara rubber in the several gardens continue to grow well, but no rubber has yet been prepared from them."

Dominica.

The early account of Ceara rubber trees in this island was communicated to Kew by Dr. H. A. Alford Nicholls, in 1884, as follows:—

"This is now established in the island, and the tree has taken very kindly to the soil. From small experiments I have made, the juice appears to be abundant and very rich in rubber in the dry months. The seeds have been borne abundantly, and I have distributed them to planters here and in Grenada."

Later Information.

The most recent account of Ceara rubber in South America has been obtained as the result of a visit made to the north-east coast of Brazil by Mr. Esme Howard and Mr. R. H. Biffen, Demonstrator in Botany at the University of Cambridge.

The following letter, addressed to the Governor of Jamaica, by Mr. Howard, was published in the *Jamaica Bulletin* (Vol. IV., p. 242):—

"I have been travelling in Mexico and Brazil for some months to examine the habits of the different rubber-producing plants of those countries with a view to finding out which are the most suitable for plantations. In Ceara, Brazil, I bought several thousand seeds of *Manihot Glaziovii*, which I think will grow well in many parts of the West Indies, meaning to distribute them in various islands for the purpose of experiment. It seems to me that parts of Jamaica would be well suited for the cultivation of this tree, which produces a good rubber, fetching at present where well collected and cured, the second highest price of any rubber on the market, *viz.*, about 3*s.* 3*d.* per lb. *Manihot Glaziovii* will grow well on hill sides in a rocky and rather poor soil. We found it growing in Ceara up to a height of 3,600 feet above the sea. It is a rapid grower and can be tapped in five years after planting, provided it has grown well. I believe a rainfall of about 100 inches or more is most suitable for it, but it will do with much less, say 65 or 70 inches."

The occurrence of the plant at an elevation of 3,600 feet, and the wide range of conditions under which it appears to thrive are facts that have not hitherto been fully recognised. It is quite possible that we may yet see successful plantations of Ceara rubber trees established in districts that have been regarded as unsuitable, and under conditions that may afford a sufficient yield of rubber to render the enterprise remunerative. Mr.

Biffen has been good enough to furnish the following particulars as the result of personal observations on trees in the wild state :—

"The leaves fall in August and September. Seeds produced very abundantly ; ripe in September ; they keep their power of germination well. The tree is apparently very liable to a dry-rot, for rotten branches are continually falling."

"Growth is very rapid ; in Baturité we saw one-year old plants 10 to 12 feet high ; in five to six years it is ready to tap ; then it is some 25 feet high and 8 to 9 inches in diameter."

"Propagated either from cuttings or from seeds. So far nurseries have failed in Ceara. Shade for established trees is unnecessary. Large plantations are now being made in the district."

"The tree has a singularly wide range of conditions ; it grows in the desert plains where rainfall is said to be under 50 inches, and the vegetation is scorched up for the greater part of the year ; also, in the mountains (plantation at 3,500 feet at Monte Alegre) where rainfall, I should say roughly, is over 100 inches. In the mountains the temperature falls even below 60° F. at night."

"The tree is never found in marshy soil ; apparently it thrives best in somewhat scanty soil among granite boulders."

"The rubber is exported in three forms :—(*a.*) In pale yellow-brown threads, $\frac{1}{4}$ inch in diameter and several inches in length, obtained by peeling off the thin layer of old bark and making a slight incision with a narrow-bladed axe. A small quantity of latex flows and coagulates on the trunk. (*b.*) In small flat cakes prepared by tapping the base of the tree and allowing the latex to flow on the ground and coagulate there. Hence the rubber contains large quantities of dirt on its lower surface which is removed to a certain extent by rubbing in coarse-meshed sieves. (*c.*) By smoking with the vapour from the burning nuts of a palm, in a similar manner to Para rubber. So prepared it contains a large quantity of water, which partially sweats out on exposure to the heat of the sun. The exudation on evaporation leaves a brown resinous substance. This last method is becoming very general."

"To collect the latex small tin cups are used ; each tree is tapped 80 days, divided, by an interval of about three months, into two periods of forty each. Under this system the tree is said to live for 15 to 20 years."

"The tapping is always done in the dry season—from July to December."

"The average yield per tree is from $\frac{1}{2}$ to $1\frac{1}{2}$ kilos. (1 to 3 lbs.) per year ; coagulation may be effected by churning, or by the addition of an excess of water, or salt solution. In the former case the rubber particles which are unprotected by any film (as the fat particles of milk are) simply adhere to form a mass."

"In the case of the addition of excess of water, salt, or smoking, coagulation is brought about by means of the globulin present (Green, *Proc. Roy. Soc.*, 1886, p. 39). This coagulates at 74–76° C., or on dilution, etc., and tangles up the rubber particles in its meshes, much as white of egg gathers up particles in suspension when used for clearing jellies."

Summary.

The result of experience so far gained in the experimental cultivation of the Ceara rubber plant may be summarised as follows :—

1. The plant is readily propagated both from seeds and cuttings. Seeds are abundantly produced in almost every part of the world where the plant has been introduced. They may be gathered from plants when only three to five years old. There is therefore the great advantage that a large area could be planted within a comparatively short period. Sowing the seeds in the position where they are to grow permanently is universally adopted in Brazil. It is possible, if adopted elsewhere, this plan would greatly reduce the cost of establishing plantations.

2. The Ceara rubber plant is very hardy, a fast grower, free from insect and fungoid attacks, requires little or no attention when once established and thrives in poor, dry and rocky soils unsuited to almost any other crop. It is evident, however, that the yield of a few trees cannot be remunerative and only large areas can hope to make the industry a paying one.

3. It produces a good class of rubber, second only when well prepared to the best Para rubber. For this there is a steady and continuous demand. The yield per tree is apparently small, but a return is obtained earlier than from any other rubber plant. With thick planting and judicious thinning as the trees grow up, it may be possible to increase the yield hitherto recorded ; while with skilful treatment the permanent trees may be tapped twice yearly and last in a productive state for 15 to 20 years.

4. In spite therefore of the apparent want of success which so far has attended experiments with Ceara rubber plants in Ceylon and other countries, the increasing importance of rubber as an article in large demand in all civilized countries at good prices, suggests a reconsideration of the merits of this interesting plant. In many of our colonies possessing a dry climate and a poor stony soil, it is possible that large areas could be profitably occupied with Ceara rubber trees so grown as to provide annual crops for tapping.

DXCIII.—MANILA HEMP IN BRITISH NORTH BORNEO.

(*Musa textilis*, Nees.)

Information respecting the important cordage fibre obtained from *Musa textilis*, the whole supply of which comes from the Philippine Islands, was given in the *Kew Bulletin* for April, 1887 (pp. 1–3). More recent information was published on the same subject in the number of the *Kew Bulletin*, devoted to an account of the "Species and Principal Varieties of Musa," for August 1894 (pp. 248 and 289, 290, with a figure). A further brief note appeared in the following year (*Kew Bulletin*, 1895, p. 208).

At the request of Kew, Mr. W. B. Pryer, who is engaged in agricultural enterprise in British North Borneo, has been good

enough to prepare the following notes respecting the experiments now being carried on in that part of the world in cultivating Manila hemp :—

The stems of all the *Musaceæ* yield fibre of more or less strength, but that obtained from *Musa textilis* is the best. From the indigenous or wild *Musa textilis*, however, the percentage of fibre of proper strength is so small that it does not pay to extract. It is from a cultivated variety that marketable Manila hemp is obtained.

The wild plant of *Musa textilis* is known by the natives as *Saying Grotei* or *Gerötei*, and the fibre-yielding variety as *Saying Lanut; Saying* being their name for all bananas and plantains. Of *Saying Lanut* there are several sub-varieties, such as *Lanut pula* (red *lanut*), *Lanut batang*, and others. In general appearance *Musa textilis* varies very little from *M. paradisiaca*, the ordinary banana, but a sharp eye will soon notice that the leaves are narrower and more pointed, and of a paler or more sea-green colour, while the stems are of a dark pickled-cabbage colour with broad irregular streaks of a dirty green.

Musa textilis requires a more equable climate than *M. paradisiaca*, and does not thrive in any country in which there is a distinct dry season ; it also demands a good soil and a warm temperature. Its present cultivation is restricted almost entirely to certain parts of the Philippine Islands and to the adjacent coast of Borneo. In fact, the requisite conditions of climate and soil are found in that part of the world only. It does not die absolutely if exposed to a drought of two or three weeks, but if spells of dry weather occur at too frequent intervals its growth is stunted very materially : but again, although it prefers rain every two or three days, it does not like a continuously wet season. Even in the Philippines its range is restricted. It is chiefly found on the eastern side, and there only it thrives really well.

In districts where it does well it requires little attention. The cheapest way of planting it is to get natives to fell and clear the forest and plant hill rice under an agreement that when (or before) they have taken their crop they are to put in Manila hemp suckers. These suckers are planted some 10 or 11 feet distant from each other, and it is well to give them two or three rough weedings during the first few months to give them a start. After this they can be left almost to take care of themselves ; in fact, a few of the coarser large-leaved weeds may be left, as they tend to keep the ground cool and draw the plants up into larger stems than would otherwise be the case. When the plants are well up, however, it is best to cut down all other large plants, and the plantation will then take care of itself with only one day's going over every three months or so.

Almost any lay of land will do for Manila hemp as long as it is not too swampy or too steep, but it thrives best on rich flat land, and does not much mind a flood as long as the water does not stop too long on the land or leave it swampy afterwards.

Manila hemp suckers take longer to sprout than the ordinary banana, and send up fewer shoots, but in three weeks or so from the time the sucker is put in, if the weather is fairly favourable, the first shoot will be seen, which will be succeeded by one or

two more. It will at least be sixteen months before the main shoot is fully matured and ready to throw out its fruit spathe. This is the best time to cut it down for fibre. If so desired, however, it can be utilised at an earlier age, but the percentage of hemp obtained is very small. This is to some extent compensated for by the better quality of the hemp obtained.

Within three or four months of the first shoot showing, a careful man should go over the entire place to destroy any plants that have come up *Gerötei* instead of *Lanut*. The same process should be repeated later on, as several which looked like true *Lanut* at first will ultimately be found to have developed into *Gerötei*. Once a stool is well established as *Lanut* it always remains so.

At the age of twelve months when the main stem will be nearly fully grown, though not fully matured, two or three others will be of considerable size and some four or five small suckers will be coming on. In time the ground will be pretty well covered. As the older stems are cut down the young suckers grow up and take their place. When it has arrived at this state a Manila hemp plantation requires scarcely any attention as long as the workers do not open it up too freely by cutting over many stems, or allow the jungle plants to encroach too much. As an instance of the longevity of *Musa textilis*, I may mention one stool twenty years old that has not cost a cent, but has yielded stem after stem for treatment at frequent intervals during that period.

The above remarks are based upon Manila hemp in North Borneo. In the Philippines it would seem to take (if there is not some mistake in the observation) nearly double the time to mature.

The "stem" of the plant is composed of overlapping layers of the leaf stalks, somewhat similar to a stick of celery, but firmly bound together. The fibre is found just below the surface on the outer side of these stalks. A stem weighs from 50 to 80 lbs. No machine that I am acquainted with has yet been discovered that will extract it to pay. The native method is simple and cheap. The stem is cut down and each leaf stalk detached from the others. After this the operator sits down with the end of a stalk in his lap, he then makes a slight incision just beneath the fibre at the end, and giving a smart twitch, brings away a strip or ribbon of the cuticle with the fibre in it, from the whole length of the stalk, much in the same way that the fibrous part of a rhubarb stalk is taken off when preparing it for cooking. This operation is best performed on the plantation itself, as the discarded portions of the stem remain as manure. When a sufficient number of ribbons are obtained they are carried to a hut for treatment. The appliances used for the actual extraction of the fibre are of the most primitive and inexpensive character. A blunt knife is obtained and a hole is made in the front end of it, through which a string is passed and to which a couple of bricks or stones are tied. The knife is then attached to a block of softish wood, the blade of it pressing on the wood against which it is held by the weight of the tied-on stones. Another piece of thin rope or string is tied through the same hole in the knife, running over a bit of wood above it, to a treadle worked by the foot. All is now complete. The operator twists the end of one of the ribbons round a small piece of wood so as to get a firmer hold, and

slipping it under the knife allows the blade to descend upon it; a steady pull drags the fibre underneath the knife, which holds back all the pith, weak fibre, and other useless matter. As the strain is heavy it constitutes a guarantee that all the fibre that is not broken is of proper strength, and the result is pure strong fibre. A boy can clean in a similar way the few inches of the end which was wrapped round the piece of wood, and the fibre is then hung over a pole to dry. This is soon done if it is a fine day, and the hemp is then ready for market.

These operations are quite simple and can be performed by anyone; but some force is required to pull the fibre under the knife, and the particular muscles brought into play soon tire if the operator is new to the work. Men who have been brought up to hemp pulling can go on for hours without any discomfort.

Some men claim to be able to make half a picul (66 lbs.) of hemp in a day; but the most I have ever seen produced by one man in a day was 37 catties (a shade less than 50 lbs.). With the fibre at $6 a picul this quantity would sell for $2·24, a high rate of pay in a country where wages are normally 30 cents a day.

It is needless to add that it would not be advisable to employ men on day wages to prepare Manila hemp, as so much depends upon the amount of force put into the work and consequently the quantity of hemp produced.

W. B. Pryer.

DXCIV.—CAPE SUMACH.

(*Colpoon compressum*, Berg.)

The "Bark Bosch" is a bush of about six feet, confined to Cape Colony and Natal, belonging to the Sandal-wood family (*Santalaceæ*). It is locally used for tanning leather. It has also been described as *Thesium Colpoon*, Linn., *Fusanus compressus*, Murr., and *Osyris compressa*, A. D. C.

It has been investigated by Mr. Arthur George Perkin, F.R.S.E., in the Clothworkers' Research Laboratory, Dyeing Department of the Yorkshire College, Leeds. He has published the following account in the *Journal of the Chemical Society* for 1897 (pp. 1132–5):—

"My attention was drawn to this material by Professor Procter during its examination as a tanning material in the Leather Industries department of this College, and to him I am also indebted for the subjoined description of its general properties.

"The leaf is much used in South Africa under the Dutch name of 'Pruim-bast,' as a substitute for sumach for tanning; only the younger leaves are gathered.

"According to analyses made in the Leather Industries laboratory, and also by Mr. A. N. Palmer, it contains about 23 per cent. of a catechol-tannin giving green-blacks with ferric salts, a precipitate with bromine water, and with ammoniacal cupric solutions a precipitate which is soluble in excess of ammonia. It is quite as strong as the average Sicilian sumach (*Rhus Coriaria*) and although its tannin is very different chemically from that in

the latter, it produces a very similar leather. Its employment, like that of the true sumach, is confined to the tannage of light leathers and to brightening the colour of goods which have been tanned with the bark of *Rhus Thunbergii* and other darker coloured materials. Alone, it produces a somewhat soft but light-yellow leather. In South Africa, the leaves are exhausted with hot water and the liquor alone is used, whilst in the case of the true sumach both leaves and liquor are usually brought in contact with the leather. For the supply of the leaves employed in this investigation, I am indebted to the kindness of Mr. R. H. Coaton, of Wellington, Cape of Good Hope.

"The leaves, roughly broken by hand, were extracted in a Soxhlet's apparatus, first with ether to remove wax and chlorophyll, and subsequently with alcohol, which dissolved both colouring matter and tanning principles. The light brown alcoholic extract, after being evaporated to a small bulk, was poured into water, the mixture extracted with ether, and the small quantity of alcohol present removed from the aqueous liquid by distillation, which on cooling became semi-solid owing to the separation of crystals; these were collected with the aid of the pump, and washed repeatedly with ether, chloroform, and dilute alcohol until the washings were colourless. The yellow produce thus obtained was further purified by two or three crystallisations from dilute alcohol, and a final crystallisation from boiling water. The substance was dried at 130° and analysed.

"0·1136 gave 0·2152 CO_2 and 0·0497 H_2O. C = 51·66; H = 4·86.
0·1103 „ 0·2102 CO_2 „ 0·0526 H_2O. C = 51·97; H = 5·29.
$C_{27}H_{30}O_{17}$ requires C = 51·76; H = 4·79 per cent.

It was obtained as a glistening mass of pale yellow needles, almost insoluble in cold, and only sparingly soluble in boiling water, but readily in alcohol. When heated, it sinters at 180°, and at 185° melts to a thick, treacly liquid. The addition of ferric chloride to its aqueous solution produced a dark green coloration, and with lead acetate an orange-yellow precipitate was formed. Dilute alkalis dissolved it, yielding orange-yellow liquids.

"Experiment having shown that this substance was a glucoside, its decomposition with acid was studied in the following manner.

"0·7658 gram, dissolved in 600 c.c. of boiling water, was digested with 5 c.c. of sulphuric acid for two hours at this temperature; a yellow, crystalline product had then commenced to separate, and more of it was deposited on cooling. This was collected (the filtrate being reserved for further examination), washed with water, and dried at 160°. In this way, 0·3710 gram of a yellow colouring matter was obtained.

"0·1111 gave 0·2427 CO_2 and 0·0370 H_2O. C = 59·58; H = 3·70.
$C_{15}H_{10}O_7$ requires C = 59·60; H = 3·31 per cent.

"It formed a glistening mass of yellow needles sparingly soluble in water, somewhat readily in alcohol. In alcoholic solution ferric chloride caused a dark green coloration, and lead acetate gave an orange-red precipitate.

"The *acetyl* derivative, prepared in the usual manner, crystallised from alcohol in colourless needles melting at 189–191°.

"0·1195 gave 0·2567 CO_2 + 0·0462 H_2O. C = 58·65; H = 4·29.
$C_{15}H_5O_7(C_2H_3O)_5$ requires C = 58·59; H = 3·90 per cent.

By fusion with alkali, two crystalline decomposition products were obtained melting respectively at 210° and 195–196°; these consisted of *phloroglucinol* and *protocatechuic acid.* The colouring matter resulting from the decomposition of the glucoside was evidently, therefore, *quercetin*, a fact also corroborated on examining its dyeing properties.

"*The Sugar.*—In order to obtain some insight as to the nature of the sugar liberated in the above action, the acid filtrate from the quercetin was neutralised with barium carbonate, filtered, and evaporated to a small bulk. The amount of the sugar present in this solution being obviously too small to allow of its identification by means of crystallisation and analysis, the liquid was treated with phenylhydrazine acetate in the presence of sodium acetate in order to obtain the osazone, and the crystalline product formed was purified by extraction with small quantities of acetone and subsequent crystallisation from dilute alcohol. It consisted of glistening, yellow needles melting at 205°, apparently *dextrosazone.*

"The decomposition of the glucoside with acid can be therefore represented by the equation

$$C_{27}H_{30}O_{17} + 2H_2O = C_{15}H_{10}O_7 + 2C_6H_{12}O_6.$$

"This reaction requires a yield of 48·24 per cent. of quercetin, whereas the amount actually obtained (see above) is equal to 48·44 per cent.

"Three distinct glucosides of quercetin have been described, of which quercitrin and rutin are the best known. The former, which occurs in quercitron bark, is decomposed by acid into quercetin and one molecule of rhamnose, whereas the latter, a constituent of rue (*Ruta graveolens*), when so treated, yields quercetin and two molecules of the same sugar. Viola-quercitrin, the third, obtained by Mandelin (*Jahresber.*, 1883, 1369) from the flowers of *Viola tricolor vivariensis*, gave, in a similar way, quercetin and glucose, as indicated by the following equation, which is based upon the old formula of this colouring matter.

$$\text{"}C_{42}H_{42}O_{24} + 5H_2O = C_{24}H_{16}O_{11} + 3C_6H_{12}O_6.$$

"As Mandelin's full paper is published in the Russian *Pharmaceutical Journal*, to which I have not access, it is not possible to be certain whether this equation is based upon the quantity of quercetin liberated when this glucoside is decomposed by acid. Consequently, the formula of viola-quercitrin, $C_{42}H_{42}O_{24}$ (C = 54·19; H = 4·51), if corrected according to the true formula of quercetin, may be expressed in two ways.

"$C_{21}H_{20}O_{12}$ (C = 54·31; H = 4·31) or $C_{27}H_{26}O_{15}$ (C = 54·91; H = 4·40).

$$C_{21}H_{20}O_{12} + H_2O = C_{15}H_{10}O_7 + C_6H_{12}O_6.$$
$$C_{27}H_{26}O_{15} + 4H_2O = C_{15}H_{10}O_7 + 2C_6H_{12}O_6.$$

"Of these, the latter formula, though possessing a somewhat high percentage composition, would appear more probable, giving,

as it does, a yield of quercetin (51·19 per cent.) which closely agrees with that required by Mandelin's own equation (51·61 per cent.). These figures, however, prove without doubt that the glucoside present in Cape sumach cannot be identical with viola-quercitrin, and must therefore be a new glucoside of quercetin. It is proposed to name this substance *Osyritrin*, derived from one of the names of Cape sumach (*Osyris compressa*).

"*The Tannin.*—Although it is not intended in these investigations to study thoroughly the tannin matters which are present in the plants under investigation, it is desirable to determine the general characteristics of those not previously isolated, as in the case of Cape sumach, for comparison with the accompanying colouring matters. For this purpose, the light-brown filtrate from the osyritrin, after removal of final traces of this glucoside by further evaporation and cooling, was treated with lead acetate solution drop by drop until, on filtration from the dark-coloured precipitate, a pale orange-coloured liquid was obtained ; the latter was then treated with sulphuretted hydrogen to remove lead, and evaporated to dryness.

"In this way, an orange-coloured, hygroscopic, transparent, glassy mass was obtained which, in aqueous solution, coagulated albumin and gave a dark green coloration with ferric chloride. Dilute alkalis dissolved it, forming orange-yellow solutions which became darker on heating, and on exposure to air developed a blood-red tint. It was found to be a *tannin glucoside*, for on treatment with boiling dilute sulphuric acid there was formed, together with a sugar, a reddish-brown, insoluble product closely resembling the so-called anhydrides or phlobophanes which are produced from so many tannin matters in this way. On fusion with alkali, both glucoside and anhydride yielded *protocatechuic acid.*

"This tannin closely resembles, both in description and properties, quinotannic acid (Schwarz, *Jahresber.*, 1851, 411) and quinovatannic acid (Hlasiwetz, *Annalen*, **79**, 129), which are decomposed by acid into a sugar and an anhydride, and yield protocatechuic acid on fusion with alkali.

"Dyeing trials with Cape sumach were carried out on woollen cloth mordanted with chromium, aluminium, tin, and iron ; full buff, pale orange yellow, pale yellow, and pale greenish-black shades were obtained, respectively."

DXCV.—MISCELLANEOUS NOTES.

Mr. J. A. GAMMIE, Deputy Superintendent of the Government Cinchona Plantation in Sikkim, has retired from that post. Mr. Gammie went out from Kew in 1865. His services have always met with warm appreciation from the Government of Bengal. His share in working out in a practical form the process by which a cheap supply of quinine is now ensured to India has already been recorded in the *Kew Bulletin* (1890, pp. 33, 34). A few words may be quoted from the Memorandum by Mr. C. H. Wood, late Government Quinologist, already printed :—

"With great perseverance he mastered one detail after another, using only the simple appliances that he found at hand, until he

was able to employ the process on a considerable scale. The valuable results therefore which have been thus far attained in the practical application of the process, are entirely due to his skill and energy."

Mr. ROBERT PANTLING has been appointed Deputy Superintendent, Government Cinchona Plantations, Sikkim, in succession to Mr. J. A. Gammie. Mr. R. Pantling went out from Kew in 1879 to the Royal Botanic Gardens, Calcutta.

Mr. JOHN HENRY HOLLAND, formerly a member of the gardening staff of the Royal Gardens and since 1896 Assistant Curator of the Botanic Gardens (Station) Old Calabar, in the Niger Coast Protectorate has been appointed by the Secretary of State for Foreign Affairs on the recommendation of Kew, Curator in succession to Mr. Billington.

Visitors during 1897.—The number of persons who visited the Royal Gardens during the year 1897 was 1,239,683. That for 1896 was 1,396,875. The average for 1887–96 was 1,431,665. The total number on Sundays was 485,544, and on week days 754,139. The maximum number on any one day was 84,431 on June 7, and the smallest 57 on March 18.

The detailed monthly returns are given below :—

January	12,961
February	36,124
March	50,438
April	169,090
May	165,036
June	218,184
July	187,622
August	219,650
September	95,729
October	55,160
November	19,254
December	10,435
Total ...	1,239,683

Botanical Magazine for December.—*Agave Schottii* is a small, slender species from Arizona, where it grows in abundance on the mountains at a height of 5,000 feet. The Kew plant flowered for the first time in March, 1897. *Quillaja Saponaria* was communicated by Thomas Hanbury, Esq., in whose gardens at La Mortola it has recently flowered. This plant, which is a native of Chili, produces a hard wood, but it is chiefly valuable on account of the soapy properties of its bark. The pretty

Peruvian *Odontoglossum retusum* was sent to Kew by E. H. Woodall, Esq., of Scarborough. *Kniphofia breviflora* flowered at Kew in October, 1896. It has small, pale-yellow flowers arranged in a dense raceme. *Habenaria rhodocheila* has flowers with green sepals and petals, while the deeply lobed labellum is usually orange-red. Tubers of this plant were sent to Kew by C. Ford, Esq., Superintendent of the Botanic Gardens, Hongkong.

Botanical Magazine for January.—*Camoensia maxima* is a climbing leguminous plant from Western Africa, discovered in the Congo region by Christian Smith in 1816. It was introduced into the Royal Gardens in 1873, when some seeds were received from Mr. J. J. Monteiro. Its magnificent flowers are very fugacious. *Paphiopedilum Victoria-Mariæ* is the name adopted for an orchid from Sumatra, originally described as a *Cypripedium*. The plant figured was sent to Kew by Messrs. F. Sander & Co., of St. Albans. *Strobilanthes dyerianus*, native of Burma, was received at Kew from the Botanical Gardens, Singapore, and the flowering specimen figured was communicated by Mr. R. I. Lynch, A.L.S., Curator of the Botanical Gardens, Cambridge. It first attracted attention as a garden plant on account of its brilliantly coloured foliage. The flowers are pale violet-blue, borne in erect spikes. *Lathyrus splendens*, seeds of which were sent to Kew by Prof. E. L. Greene, of the Catholic University, Washington, is one of the most beautiful species of the genus to which it belongs. It is a native of California, and not quite hardy at Kew. *Sievekingia reichenbachiana*, a rare orchid from Ecuador, is in cultivation in the gardens of Sir Trevor Lawrence. The genus belongs to the *Stanhopieæ*, not to the *Oncidieæ*, as inadvertently stated.

Flora Capensis.—The completion of the sixth volume of this work, containing the orders *Hæmodoraceæ* to *Liliaceæ* was announced in the *Kew Bulletin* for last year (pp. 226, 229). It was resolved to continue with the seventh volume for the reasons explained in the following prefatory note by the Director, which was prefixed to Part I., issued in December last :—

"The elaboration of the Monocotyledonous orders, to which the seventh and concluding volume of the Flora Capensis is devoted, is a task of no small difficulty. They can only, indeed, be dealt with satisfactorily by those who have made them an object of special study. But as it has been my good fortune to secure the co-operation of botanists who are acknowledged authorities on these orders, it has been determined to proceed with them at once. And it seemed especially desirable to lose no time in publishing the enumeration of the grasses, which must necessarily be of great practical interest in a country so largely pastoral as South Africa."

Flora of Tropical Africa.—The resumption of the publication of this work at the request of the Marquis of Salisbury was announced in the *Kew Bulletin* for 1894 (pp. 17, 18). In the meantime descriptions of new species collected by various travellers have been published in the *Bulletin* in anticipation under the title of *Diagnoses Africanæ.* Of these ten numbers have appeared, including 599 new species.

The first part of the continuation was issued in December last, with the following preface :—

The last of the three published volumes of the *Flora of Tropical Africa* appeared in 1877. Since then our knowledge of the vegetation of this region has increased very greatly. Large tracts which were unexplored botanically at that date have yielded numerous and copious collections. In resuming the work it has therefore been found necessary to more clearly define the regions into which Professor Oliver divided the whole area. In attempting this, advantage has been taken as far as possible of political boundaries, since they admit of easy recognition. The regions may now be briefly defined as follows :—

1. Upper Guinea.—The Western Coast region from the mouth of the Senegal river to the southern boundary of the Cameroons. It contains practically the whole of the Niger basin. It is bounded on the north by a line stretching from the mouth of the Senegal river to Lake Chad ; on the east by the 15th parallel of East longitude to its intersection with the southern boundary of the Cameroons, which bounds it to the south. It includes also the island of Fernando Po.

2. North Central.—This includes the Sahara. It is bounded to the north by the Tropic of Cancer ; on the west by the Atlantic ; on the east by the 26th parallel of East longitude ; on the south by the Upper Guinea region and the Congo Free State.

3. Nile Land.—The Nile basin. It is bounded to the west by the 26th parallel of East longitude ; to the east by the Red Sea and the Indian Ocean ; to the south by the Congo Free State and German East Africa.

4. Lower Guinea.—The Western Coast region from the southern boundary of the Cameroons to the Tropic of Capricorn. It contains the lower course of the Congo, and is bounded to the east by the Congo Free State, the river Kwango, and the 20th parallel of East longitude.

5. South Central.—Comprises the Congo Free State, Lunda and Portuguese West Africa, east of the 20th parallel of longitude (Lobale).

6. Mozambique.—The East Coast from the northern boundary of German East Africa to the Tropic of Capricorn. It includes Portuguese East Africa and British territories to the Tropic.

As public interest is largely centred in the Petaloid Monocotyledons of Tropical Africa, inasmuch as they lend themselves most readily to cultural treatment, it has been thought advisable to deal with these in the first instance.

For the geographical data the following map has been chiefly used :—Spezial-Karte von Afrika. Gotha : Justus Perthes. 1885.

The preface to the completed volume will enumerate the most important sources of the material upon which it has been based.

The Flora of Lord Howe Island.—A complete list of the vascular plants known from this remote island has been compiled by Mr. W. B. Hemsley, F.R.S., Principal Assistant in the Herbarium of the Royal Gardens, from materials in the Kew Herbarium. It is published in the *Annals of Botany* (vol. x., pp. 221—284), together with a brief description of the island and its vegetation, derived from various sources. The general distribution of the genera and species is given, and synonyms so far as it seemed desirable, with references to the first place of publication, to Bentham's *Flora Australiensis*, Hooker's *Handbook of the New Zealand Flora*, and other publications. Altogether 209 species, belonging to 159 genera, are tabulated. Counting ferns as one, 69 natural orders are represented. There are 4 endemic genera and 50 endemic species. Prominent among the endemic plants are the palms: *Hedyscepe canterburyana*, *Clinostigma mooreanum*, *Howea belmoreana* and *H. forsteriana*, and the giant iridaceous plant, *Moræa robinsoniana*—all in cultivation in this country, and some of the palms in thousands.

Pelicans.—Through the kindness of Rear-Admiral Blomfield of the Port House, Alexandria, and of Dixon Bey, of Port Said, six fine specimens of *Pelicanus crispus* were obtained from Lake Menzaleh and despatched to this country in December last. Through the kindness of the Secretary, Philip Sclater, Esq., F.R.S., the officers of the Zoological Society took charge of the birds on their arrival. Two were selected for Kew and the remaining four handed over to the Royal Parks.

Portrait of Robert Brown.—The Bentham Trustees have presented to the collection of portraits of botanists in the Museums of the Royal Gardens one of the celebrated botanist Robert Brown, F.R.S. (1773–1858), President of the Linnean Society (1849–53). It was painted by Pierce for Lady Franklin about the year 1856. From 1801–5, Robert Brown was naturalist to Flinders' expedition for the survey of the coasts of New Holland, to which Sir John Franklin was attached as midshipman.

Philippine Islands' Flora.—Mr. A. Loher, who has spent some years in investigating the natural history of this Archipelago, has sent his very extensive botanical collections to Kew to be worked out. Most of the plants were collected in the northern part of Luzon, and many are from the higher mountains. The latter are particularly interesting, and include a number of temperate types not previously known to exist in the Philippines —*Ranunculus*, for example. Another, and an unexpected element in the flora, is the presence of Himalayan types, such as *Clematis hedysarifolia* and *Berberis nepalensis*. Altogether this collection promises to be of great value and interest.

Flora of Tibet.—During the last five years the Kew Herbarium has been enriched by a number of collections of dried plants from various parts of Tibet, some particulars of which have appeared in the *Kew Bulletin* from time to time. (See 1893, p. 369; 1894, p. 136; and 1896, pp. 99 and 207–216; also Hemsley in the *Journal of the Linnean Society*, xxx., pp. 101–140, plates 4 and 5.)

Several other small collections have reached Kew since; and one, by far the largest ever received from "Tibet," was presented last July, but has not as yet been completely examined on account of the pressure of other work. This collection was made by H. E. Hobson, Esq., who is stationed at Yatung, on the eastern frontier of Sikkim and Western Chumbi, between Yakla and Gnatong. Botanically it is in the humid Himalayan region, where the vegetation is comparatively luxuriant and diversified, whereas all the collections previously noticed are from the arid sterile country, which begins a very little to the north. Mr. Hobson's collection consists of about 1,500 specimens, largely of herbaceous plants, amongst which there are doubtless a good many novelties.

Flora of Mongolia.—Mr. and Mrs. Littledale have made another adventurous journey into the heart of Central Asia; this time to North-western Mongolia, by way of Siberia. Mrs. Littledale made an excellent collection of dried plants, which has been presented to Kew. It comprises between two and three hundred species. Although there are probably few, if any new species, the specimens are specially valuable on account of the admirable care with which Mrs. Littledale has prepared them. In all cases where it was possible the entire plant, including root, was procured. Few professional collectors take as much pains as Mrs. Littledale has done.

Mangosteens from the West Indies.—Plants of this well-known and delicious tropical fruit have been widely distributed from Kew to the West Indies. The Mangosteen is a native of the Molucca Islands, and is cultivated in the Straits Settlement, Java, and in one or two localities in India and Ceylon. The fruit is regularly shipped from Singapore to the Calcutta market. The first West Indian fruits were produced at the Botanic Gardens, Trinidad, in 1875. In September, 1891, the Governor of that island forwarded some West India Mangosteens for presentation to Her Majesty the Queen. The Mangosteen fruited for the first time in the Jamaica Botanic Gardens in 1886 (*Kew Bulletin*, 1895, p. 79). Last year a box was received at Kew from Mr. J. H. Hart, F.L.S., of Trinidad, containing nine fruits of Mangosteen, which were perhaps, the first to reach this country in a condition to allow their merits to be appreciated. Each fruit was separately packed in a compartment with pine wool. Owing to the firm consistency of the outer wall of the fruit, it appears to travel well. The fruits were distributed to the Secretary of State for the Colonies and others. The reports received were uniformly favourable. One fruit

was sent to Mr. George Monro, one of the leading fruit merchants in Covent Garden, to obtain an opinion as to prospects of shipments of Mangosteens to this country. Mr. Monro reported :—

"Yours to hand. I cut open the fruit and showed it to some of my best customers, and they think with me that, if they came in good condition, and not too many at first, a business could be worked up in them. At any rate I should like to try some, and if sent, will do all I can to get a trade for them. They appear to be a fruit that would carry well."

Coffea stenophylla.—The Highland Coffee of Sierra Leone has been fully described in the *Kew Bulletin* (1896, pp. 189-191, with plate). Seeds and plants have also been distributed from Kew to most tropical countries. The following particulars communicated by Mr. J. H. Hart, F.L.S., respecting the success of plants that have lately fruited in Trinidad, only a few feet above the sea-level, will be read with interest :—

"Some four years ago we received a new kind of Coffee from Kew. This has now fruited for the first time, four years from seed. The trees are in robust health, and have given for a first yield, a very fair return. This Coffee is quite distinct from anything hitherto grown in the West Indies, and appears likely to develop into a valuable minor product. The berries instead of being red when ripe, as in the Arabian varieties, are a dark purple, and the bean is small and attractive-looking. When dried and cleaned it has much the appearance of the finest Mocha. The flavour when made into a cup of coffee is excellent, being fully equal to the finest Arabian, from which there is little to distinguish it in appearance when prepared in the same way. The trees are much more vigorous than Arabian Coffee, they have a small, dark, shiny leaf, but the individual branches are somewhat smaller than those of Arabian, and very much less robust than *Coffea liberica.* Our trees are now eight feet in height and would appear to be willing to go higher if we would let them. So far as our experience has gone with *Coffea stenophylla* there is good reason to hope that it will prove a valuable introduction."

At the request of Kew, seed not required in Trinidad has been distributed for experimental cultivation in other portions of the British West Indies.

Cashew Spirit.—The singular fruit of the Cashew (*Anacardium occidentale*), a native of the New World, is now well known in most tropical countries. The tree is somewhat like a walnut in appearance but with large, leathery, entire leaves ranged alternately on the spreading branches. The flowers, in large terminal panicles, are fragrant and rose-coloured. The fruit, when fully developed, is kidney shaped and is placed at the end of a thickened pear-like receptacle. When the coats of the fruit are removed the kernel is often roasted and forms the Cashew nut of commerce In India and the tropics generally these are used as a substitute for

almonds. They contain an oil that is said to protect the floors of houses from the attacks of white ants. The pulpy receptacle is also edible and has an agreeable flavour. It is sometimes called in the West Indies the Cashew-apple. A new use appears to have been found for this in Portuguese East Africa. According to a Report furnished by H.M. Consul in that region (*F.O. Reports, Annual Series*, No. 1463, pp. 14, 15) the natives inhabiting the peninsula opposite the island and city of Mozambique, since they have been emancipated, "are bent on enjoying the sweets of indolence . . . . the only agricultural industry carried on now consists in brewing and distilling the juice of the fruit of Cashew trees."

The following is the Consul's report of this apparently unique industry :—

"Opposite the island and city of Mozambique there is a peninsula, about 12,000 acres in area, connected with the mainland by a narrow neck of land that is guarded by garrisons on each side.

"On this peninsula, which forms part of Terras-Firmes, the Portuguese have made efforts at agricultural industry.

"In the days of forced labour the plantations are said to have been very profitable. The numerous ruins of substantial farmhouses and residences testify to the wealth of the former planters. On the suppression of the slave trade the slaves were suddenly emancipated, without measures being taken to supply their place. At present the natives are bent on enjoying the sweets of indolence. A few days' labour procures enough to pay for their clothing. Food can be obtained from friends or robbed from the landowners.

"The laziness of the natives and their pilfering propensities result in reducing the value of property. An estate which formerly produced a revenue of 2,000*l.* per annum hardly yields 200*l.* at the present day.

"The only agricultural industry carried on now consists in brewing and distilling the juice of the fruit of cashew trees, and brewing the sap of cocoanut palms.

"Taxation on this industry reached its limit last year. The landowners collectively petitioned the King of Portugal to annul the recent law on taxation. They demonstrated that if it were enforced they would be required to pay to the Government amounts far exceeding their incomes; in fact it would oblige them to cease manufacturing fermented and distilled liquor.

"It would seem that the law referred to was intended to prohibit the manufacture of liquor, and thus prevent the natives from obtaining it.

"During the cashew season (October, November, and December) the natives give themselves up to their favourite beverage, and during that time they become perfectly useless. A great end would be obtained if this liquor could be kept away from them. It is easy to prevent Europeans from manufacturing it, but I am afraid it will be impossible to prevent the natives from doing so.

as there are millions of trees in places beyond Portuguese control where at present natives brew and distil liquor to their hearts' content, without paying taxes to the Portuguese.

"The following is extracted from the petition alluded to, which was signed by 86 Portuguese and Indian landowners :—

'It is notorious that neither industry nor agriculture properly so-called exist in this territory.

'The plantations about Mozambique consist of small tracts of land, covered with cashew trees and cocoanut palms that grow and bear fruit almost spontaneously, and require but the slightest care of the cultivator. Fermented liquor is obtained from both trees, and that of the cashew is also distilled.

'The income obtained from this industry is small, and hardly does more than cover the expenses.

'Nevertheless, it is the only agricultural industry undertaken by the landowners of this country as a means of livelihood.

'It is necessary to point out that the soil of this region only adapts itself to the cultivation of cocoanut palms, cashew trees, and certain vegetables of little importance. No other kind of cultivation can be undertaken with profit, as experience has frequently demonstrated. The aridity of the soil, irregularity of rains, as well as the absence of labour, are the chief causes of failure.'"

Jicamilla.—G. W. C. Griffith, Esq., H.M. Vice-Consul at Tampico, has sent to Kew a number of tubers of the plant bearing this name in Mexico, together with branches bearing fruit. The only record of this name in an English publication, which has come under our observation, is in the *Pharmaceutical Journal*, (Oct. 31, 1896, p. 381), where it is referred to as *Jatropha purgans*. It is uncertain what is meant by this name, because, so far as known, it has never been published with a description of the plant it is intended to designate. *Curcas purgans* (Jatropha Curcas), a well-known and widely dispersed species, may possibly be intended, but the specimens sent by Mr. Griffith certainly belong to *Jatropha macrorhiza*, Benth. (*Pl. Hartw.* p. 8), apparently a rare plant. It was collected by Hartweg in 1837, and his specimens at Kew are labelled with the locality, "Aguas Calientes" in the Benthamian, and that of "Zacatecas" in the Hookerian Herbarium.

From a passage in Hartweg's narrative of his journey (*Trans. Hort. Soc. Lond.*, ser. 2, iii. 1848, p. 120) it is clear that the latter statement is incorrect as far as Hartweg is concerned. The plant had, however, been previously collected by Thomas Coulter at Zacatecas (n. 1469), but his specimens were not distributed till a later date, having lain in the herbarium of Trinity College, Dublin, for some years. Mr. Griffith's were obtained from Lagos, a place lying to the south of the other localities named, in the extreme east of the State of Jalisco. Until these specimens came to hand none had been received at Kew since Hartweg's were collected, some sixty years ago, although the area has been frequently collected over.

Hybrid Coffee in Mysore.—What are regarded as hybrid coffee plants, the result of cross fertilization between the Liberian and Arabian kinds, are being cultivated in some districts in Mysore. The most recent information regarding them is that contained in a Report on the Manjarabad Ghat Forests presented last year to the Government of Mysore by Mr. J. Cameron, F.L.S., Superintendent of the Lal Bagh Gardens, Bangalore.

It is evident that coffee planters in the district believe the plants to be true hybrids. No specimens, however, which would substantiate the fact have been received in this country. It is therefore impossible to express an authoritative opinion on the subject. In the meantime Mr. Cameron's account of the plants themselves will be read with interest :—

"When the Barguai estate had been well explored I was taken to the adjoining one of Oossoor, the property of Mr. Brooke Mockett. Here Mr. L. Crawford, the Superintendent, kindly showed me the hybrid coffee of which so much is now heard.

"These hybrids, with their parents, are flourishing, in quantity, on a piece of land situated near the cooly lines. On this plot, many years ago, two coffee seedlings had been planted pretty close to each other, one being Liberian, *Coffea liberica*, and the other the Coorg species, *Coffea arabica*. Both these plants, which are said to be the parents of the hybrid progeny, are still alive and both maintain their specific characters. The first two hybrids, which are now very fine bushes, came up spontaneously in the vicinity of the parent bushes about 10 or 12 years ago. Since then numerous hybrid seedlings have been detected, of which the first batch is seven years old. Mr. Crawford tells me that on Mr. Mockett's different estates they now cover six acres of land, and are not less than 5,000 in number. The variation in the different seedlings now in fruit is truly remarkable, and leaves no doubt in my mind as to the interspecific nature of their origin. I am inclined to think that in the first instance pollen from *Coffea arabica* (either the privileged bush near to the Liberian plant or others around) found its way to the Liberian species, where it fertilised the latter and subsequently produced a hybrid. Hence *C. arabica* became the male parent, while *C. liberica* fulfilled the function of seed-bearer. But being hermaphodite on both sides, there is really nothing to prevent reciprocal action, so that either species may fulfil the dual function of both parents. Being a new plant, it is probable that the seeds and seedlings of *C. liberica* were better preserved than those of the adjoining *C. arabica*, hence my opinion that the first hybrids were produced from the former and not from the latter. But subsequently counter- and intercrossing have probably taken place to produce the gradation of strains now growing on the estate. This is the only way in which I can account for Mr. Brooke Mockett's fine strain of hybrids and cross-breds. In a few bushes, the primaries are somewhat crowded with berries nearly all ripening together, just as in *C. arabica*. At the same time the leaves are larger, greener, and much firmer in texture than the leaves of the latter. This, I discovered, is the most favoured strain, as it promises crop and shows no sign of being attacked by leaf disease. In fact, all the hybrids appear to be proof against the latter pest."

Caper Industry in France.—The following interesting account, taken from *La Co-opération de Production dans l'Agriculture* by the Comte de Rocquigny, is reprinted from the *Journal of the Board of Agriculture* (vol. iv., pp. 221, 223) :—

"The caper industry of Roquevaire, in the department of the Bouches-du-Rhône, presents an interesting case of co-operation, undertaken chiefly with the object of ensuring the maintenance of the reputation of a locality for the quality of its produce. The caper producers of Roquevaire and of some other neighbouring localities have, it is stated, combined in response to an economic necessity, in order to counteract the continual depression of prices induced by the action of the local trade, which mixed Algerian and Spanish capers of inferior quality with those bought in Provence. The producers of these localities have accordingly determined to take the trade into their own hands, and have formed themselves into a syndicate for that purpose. Roquevaire contains some 3,000 inhabitants, and nine-tenths of the caper producers of the commune (who alone are eligible to the association) have engaged to deliver their whole production, amounting to some 220,000 lbs. or more, to the syndicate. The experiment is said to have proved completely successful.

"The caper is the floral bud of a bush (*Capparis spinosa*) which has been cultivated from time immemorial in Provence. This bud is picked when very small, as its quality deteriorates as it grows larger. The labour of picking the buds devolves upon the members of the association. It is usually done by women, at intervals of five or six days during the season, which lasts from the end of May to the beginning of September. When gathered, the capers are put into wine vinegar (provided by the syndicate at cost price) so as to be only just covered, and steeped for two or three months, after which they are delivered to the association, by whom they are sifted, and then replaced in vinegar in the society's cellars, being kept in barrels until sold. The producer is credited with the weight of the capers furnished by him, and the quality of the buds as determined by the sitting (at which he can be present if he chooses) is also noted. Some twenty women are usually employed at the association's headquarters for about six months in sifting, which operation is performed by hand with the aid of a metal sieve.

"The capers are classified in six qualities, the finest being worth, in 1894, about £4 per cwt., and the inferior sort about 10s. The net produce of the sales, after deducting the general expenses of the syndicate, is divided among the members proportionally to the amount and quality of their deliveries. Thus the money received from the sale of first quality capers is divided solely among those who have delivered capers of that grade, and the members have accordingly an interest in increasing the quality of the produce.

"The capers may be kept a year or more in the cellars. On being sent away they undergo a double straining, and as they have absorbed some 10 per cent. of their weight of vinegar, they keep very well without any further addition in a hermetically sealed barrel.

"The principal outlets for these capers are Russia, Germany, Sweden, England, and America. Apart from the assistance given by the consuls in those countries, the syndicate has also agents abroad, who are paid by a commission on the sales.

"As many cultivators would not be in a position to wait for their returns until the sale of the goods, the syndicate advances money at 4 per cent. to such of its members as require it, to an amount not exceeding three-fourths of the presumed value of the capers delivered. The daily receipts from the sales have hitherto proved sufficient to meet the demand for such loans; but the association has secured the faculty of obtaining, if necessary, a considerable credit at its bankers for this purpose. This can be drawn upon the signature of the president, and all the members are liable for its repayment.

"In 1893 the members of the syndicate picked 1,659 cwt. of capers, and their sale produced £3,115. This allowed of an average of 4d. per lb. being handed over to the members in 1894, or about the same as was paid by the trade, which appears to have maintained that price solely in order to retain clients among the caper-producers, and to be able to compete with the syndicate. Before the latter was established the trade only paid 2¾d. and 3d. per lb. In the season 1894-5, however, the syndicate could only distribute 3½d. per lb., owing, it is said, to the outside trade delivering mixed capers under the name of Roquevaire capers, and thus lowering the prices in the consuming markets.

"Co-operative associations for the sale of capers have also been formed in other neighbouring localities. The syndicate of Cuges undertakes the preliminary maceration of the buds, which at Roquevaire is performed by the individuals; the sifting is also done by machinery, although the results are not considered quite so satisfactory as when this operation is done by hand, but it constitutes a saving in the cost. Further, in distributing the money received from sales among its members, the Cuges association takes account only of the quantity of capers delivered, without reference to quality."

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

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DXCVI.—ARTIFICIAL INDIGO.

The *Kew Report* for 1880 contained (p. 49) a note by Professor Armstrong, F.R.S., on the then recent "discovery by Professor Baeyer, the successor of Liebig, at Munich, of a method of producing indigo artificially, which it is proposed to employ on a large scale (Patent No. 1177, 18th March, 1880)." The note concluded with the remark :—" It is difficult to avoid the conclusion that artificial indigo will most seriously interfere with, even if it does not within very few years altogether displace, the natural article."

Eighteen years have elapsed, and the prediction, if not immediately verified, is now much nearer realisation. The stages in the artificial synthesis of a natural product follow an inevitable course. The first is to ascertain, however complex, its chemical composition. The next is to put it together from substances of simpler constitution. The first attempts, although successful, are cumbrous because success is mostly only attained by circuitous methods. It is not, therefore, at first, usually available for commercial purposes. But this is only a matter of time when once the problem has been shown to be theoretically capable of solution. The next step is to simplify the manufacturing processes, and this is inexorably pursued till the artificial product can be produced more cheaply than the natural one.

In the case of indigo, this result is actually within sight.

Such a result is the inevitable outcome of the application of scientific chemistry to the industrial arts. The world views it on the whole with equanimity, for if it displaces labour in one part, it gives increased employment in another. But it is not without its drawbacks. It substitutes the factory for the field, and makes for the congestion of the urban population which seems inseparable from an advanced civilisation. Moreover, the substitution of an artificial dye for a natural one has a defect of the same kind as the substitution of mechanical work for that of the hand. The artificial dyes have the defects of their qualities; they are too good, *i.e.*, too pure. Their use is apt to lack interest.

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Alizarine has now displaced madder in dyeing Turkey red. The results are not quite the same. Natural dyes are not absolutely pure, but more or less complex mixtures, and they yield in consequence in the hands of a skilful operator peculiar tones which are not easily realised, or, at any rate, without more trouble than cheapness will allow, from the artificial substitutes. The following note, which has been kindly supplied by Dr. Hugo Müller, F.R.S., shows that the natural dye may even have practical advantages. But it is to be feared that these are not beyond the art of the chemist to imitate.

"It is now nearly 20 years ago that the synthetical production of indigo was first accomplished, and it was then generally believed that before long this remarkable achievement of organic chemistry would, as in the case of Alizarine, seriously affect the natural product and become of grave importance to the indigo planter; but in this instance this expectation was not realized as anticipated.

"The process being too complicated and costly it could not compete with the natural indigo, and, with the exception of a tentative application in cotton printing, the artificial indigo remained merely a landmark in the progress of scientific chemistry.

"Nevertheless this discovery seems to have caused the indigo planters to bestir themselves and improve their methods of working, which in turn effected a considerable reduction of the price and a consequent increase of production.

"Meanwhile, however, the chemists were not idle, and a steady progress in the improvement of the synthetical processes was made, so much so that at the beginning of last year the Badische Anilin and Soda Fabrik, Ludwigshafen, made the announcement that they were now able to compete with the natural indigo, by offering to the trade pure indigo-blue (Indigotine) at the price of 17*s*. per kilo., which is about the value of pure indigo-blue contained in commercial indigo.

"Thus, notwithstanding the much reduced value of the natural indigo, the production of artificial indigo seems now once more to have assumed a threatening importance to the indigo grower, which will have in all probability to be reckoned with.

"In an article published in the *Chemiker Zeitung* last November, Sigismund Lang discusses this subject in a spirit evidently antagonistic to the artificial indigo, and points out that the price of 17*s*. per kilo. of the artificial indigo is still too high, inasmuch as the cost of pure indigo-blue contained in the leading sorts of commercial indigo varies from 12*s*. 6*d*.—15*s*. 9*d*.—16*s*. 6*d*.; but, what is still more to the point, he calls attention to the importance of the 2—10 per cent. of indigo-red (Indirubin, Indipurpurin) contained in the better class of natural indigo, and which is said to be absent in the artificial. It appears that the presence of this colouring matter is all-important in the vat dyeing, as it causes the proper fixing of the indigo-blue on the fibre. Without indigo-red the goods dyed in the vat hold the colouring matter in much less fast a manner, and this is in fact the reason why Java indigo, which contains little or no indigo-red, is altogether unsuitable for vat dyeing.

"It remains to be seen whether this absence of indigo-red in the artificial indigo will limit its application.

"Meanwhile it ought to be mentioned that in some of the synthetical formations of indigo-blue a red colouring matter is obtained as a by product, which is supposed to be identical with the natural indigo-red, and if this is the case no doubt special attention will be given to this substance with the view of remedying the defect of the artificial indigo at present sent into the market.

"The Badische Anilin and Soda Fabrik proposed to manufacture during last year a quantity of indigo-blue, equal to 1,200 chests of 125 kilos. each, whilst the annual export from Calcutta alone is estimated at 32,000 chests."

The main source of supply of indigo is India. The *Kew Bulletin* for 1894 (pp. 322–3) contained a brief account of the history of the industry in that dependency, by Dr. George Watt, C.I.E. According to figures given by him, the total export from India in 1892–3 was of the value of 41,411,793 rupees, or about two-thirds of the value of the export of tea. According to the same authority the total area under the crop for all India might be estimated at about 1,400,000 acres. (*Dict. Econom. Prod. of India*, vol. iv., 1890, p. 422.)

DXCVII.—GAMBIA BOTANIC STATION.

The British Colony on the River Gambia (*Colonial Office List*, 1898, pp. 119-120), consists of the Island of St. Mary, British Combo, Albreda, the Ceded Mile and McCarthy's Island, situated between the falls of Barriconda and Bathurst, and 153 miles from the latter. The total area of the Colony proper is about 69 square miles or about one-fourth the size of Middlesex.

The principal productions are ground nuts, hides, beeswax, rice, cotton, maize, kous (*Pennisetum*), palm kernels, india-rubber and native "pagns" or country cloths. A considerable entrepôt trade is done with the neighbouring French Settlements. Most of the exports (of the value in 1896 of £116,981) go to France, while most of the imports (of the value in 1896 of £110,324) come from the United Kingdom. The climate is fairly healthy during the dry season. The mean temperature is 82°. The rainfall from June to October is usually very scanty, and there are prolonged seasons of drought. The cool Harmattan winds blow from November to February.

The agricultural resources of the Gambia have been discussed in the *Kew Bulletin* (1889, p. 142; 1890, p. 261; and 1892, p. 109); the meteorology for the years 1887–1891 in *Kew Bulletin* (1892, pp. 109–110); the cotton cultivation and the manufacture of the interesting "pagns" or native cloths in *Kew Bulletin* (1894, p. 191); the botany in *Kew Bulletin* (1891, p. 268, and 1892, p. 45); Gambia mahogany in *Kew Bulletin* (1890, p. 168); and the native medicines in *K. B.* (1893, p. 371).

In 1894 the Administrator made application to the Secretary of State for the services of a Curator to take charge of a Botanic

Station proposed to be established at Kotu in British Combo. In March of that year, Mr. Walter Haydon, a member of the gardening staff at Kew, who had been Acting Curator of the Botanic Station at Lagos, was appointed to the post. Mr. Haydon has continued in charge until the present time.

The following extracts giving an account of the work carried on at the Gambia Botanic Garden, are taken from the Report of the Curator for the year ending 31st December, 1897. These afford an interesting record of the efforts made to establish new industries in the Colony.

THE CURATOR to the ADMINISTRATOR of the GAMBIA.

Botanic Station, Kotu,
January 30, 1898.

SIR,

I HAVE the honour to submit my Report on the Botanic Station for the year ended 31st December, 1897.

1. Mr. G. J. Thomas was appointed Acting Curator during my absence on leave. I left the Colony on the 11th May, 1897, and returned on the 5th November following. My absence, therefore, extended over a period of five months and twenty-four days.

2. In the early part of the year a house was erected within the Botanic Gardens for the use of the Curator, who is now always resident on the Station. The house is in the centre of the Gardens and commands a view of all the ground under cultivation.

3. A low cane fence has been erected around the house and the adjoining nursery for a distance of 72 feet from the building. This was necessary in order to divide this part of the Station from the public part and add to the privacy of the dwelling.

4. The general work during the year has been devoted to making up nursery beds, sowing seeds, planting out, and digging up roots, especially those of the "Run" palm (*Borassus flabelliformis*), which had taken possession of the land ; also in making paths around the house, keeping the ground free from weeds, and in carrying on the general business of the Station.

5. Nearly all the large trees still standing within the Station ground were pruned. They were native forest trees when the Station was started and were damaged by bush fires. They now present a much healthier and more pleasing appearance.

6. A palm tree (*Elaeis guineensis*) within the Gardens is very noticeable. It is growing out of the centre of a large *Ficus Vogelii* tree. The long trailing roots of the *Ficus* embrace the trunk of the palm, and in time it will form a large tree. This specimen has also been pruned, and as it is in a prominent position its peculiarities can easily be observed.

ROADS.

7. All the roads have been kept in good condition. They would, however, be greatly improved by putting stone on them. There is a bed of rock passing close to the surface of the ground a few minutes' walk from the Station. By means of blasting, enough stone could be obtained to cover the whole of the roads in the Station. This would be a great improvement. At present the roads are formed simply of earth thrown out of the drains on each side and may at any time be washed away by heavy rains.

NURSERIES.

8. A new nursery has been established close to the house where young plants are grown until large enough to be transplanted into their permanent places. They are protected from the sun by means of shading made of fronds of the oil palm. The leaves are supported by stakes fixed firmly in the ground and raised to a height of three feet. The fronds are then placed on the top and held in position by being tied down, while long bamboos on the top keep them from being blown away. The soil in the nursery is the best in the Station and is being improved from time to time by the addition of decayed leaves and manure. At present manure is obtained with difficulty, as in the absence of a cart it has all to be brought in by wheelbarrows.

Nearly all the decayed tree stumps have now been taken up, also a very large number of the "Run" palms. An experiment to get rid of the latter by means of sulphuric acid was successful as far as it went, but after all grubbing up the roots is the most effective, though necessarily a slow process. I am glad to say the number of palms infesting the ground is gradually becoming less. The stems when cut down are burned, and the ashes distributed over the ground as manure. All the fruit borne by the female trees is cut before it ripens to avoid the seed falling down and growing.

PLANTS RECEIVED.

9. Two wardian cases and a box of plants were brought out from the Royal Gardens, Kew, on my return to the Colony. The plants in the wardian cases arrived in splendid condition, but a few of those in the box suffered and have since died. The plants n the box were decorative and ornamental plants. Those in the wardian cases were all of value as economic plants. These have since been potted into small powder kegs which answer the purpose very well. We have not the usual bamboo pots to put them into. The plants are looking healthy and growing well. There were also plants of *Castilloa elastica*, the Central American rubber. These have been put into a nursery bed where they are growing well. When the next rains come they will be transplanted to more suitable places. Most of the decorative plants are flourishing. The fuchsias and geraniums will make a good display in front of the house as decorative plants.

The wardian cases will be painted and sent back to Kew with living plants during the coming year.

WELLS.

10. A new well was sunk by the Colonial Engineer during the year, near the nursery. This will greatly reduce the labour of watering the plants in this locality. Sometimes, however, the water has failed, and the plants have suffered. I would suggest that this well be deepened. The old well, which has been here since the station was commenced, fell in during the rainy season. It has since been repaired and sunk deeper and now yields a good supply of water. The well at the bottom of the grounds should

also be deepened and built up. A water tank for holding rainwater is urgently needed for the supply of good drinking water for the house. Good water is essential in the tropics. Often the water here is practically unfit for use.

Fences and Outhouses.

11. The wire fence erected around the Station in 1895, is keeping in good condition. It is as strong now as when first erected. The posts are of the Run palm, and, so far, are free from the attacks of white ants. The gates and gate-posts were painted and tarred before the rains.

The outhouses of cane and grass have suffered badly from the ravages of the white ants, and will require rebuilding. This should be done as early as possible as the ants are destroying the tools, seeds, &c., stored in these buildings.

Economic Plants.

12. *Liberian Coffee.*—The two large trees near the main entrance gates have flowered and give signs of yielding a large crop of cherries. The trees are perhaps too tall to be good specimen plants. They are at least 10 feet high. One yielded last year about 3 lbs. of coffee berries as a maiden crop. The young coffee plants, which are distributed amongst the bananas, are looking strong and healthy. These were again attacked by insects, but with constant syringing they have become cleared of their enemies. The crop of berries gathered last year was sown in a bed in the nursery before I went on leave, but apparently failed to produce plants. I have now planted more seed so as to have young plants before the coming rains.

13. Kola (*Cola acuminata*).—The plants left in the nursery were transplanted into their permanent places during the rainy season.

14. *Cotton.*—There has been a fairly good crop of cotton picked from the plants grown last year. It is of good quality, with a long staple.

15. Jute (*Corchorus olitorius*).—The seed of this plant was again sown and better results were gained than on the previous occasion. The ground was prepared and seed sown on the north side of the station, in a rather swampy situation. It was started this year two months earlier. The fibre produced was a very fair sample for a first trial. We shall be able to produce a much larger and finer crop next season. The plant to be successful here must be sown at the commencement of the rains, say the first week in July. It must have all the rain it can get while it is growing, and the seed must be sown thinly, or the plants will fail through not having sufficient room to grow.

The following notes were taken on the crop which produced the sample of fibre submitted to the Dundee Jute Growers' Association.

The area of land sown was about a quarter of an acre. The seed was sown on June 13. Cutting the plants was begun on October 11. Retting the stems took twenty days. The number

of plants cut from the area sown was 2,800. These weighed when dried 22 lbs., and the amount of cleaned fibre obtained was 8 lbs.

The following report has been received from the Dundee Jute Growers' Association on a sample of jute grown and prepared at this station :—

JUTE from the GAMBIA COLONY.

Dundee, December 21, 1897.

DEAR SIR,

I HAVE now to advise that the sample of jute from the Gambia Colony which was returned to you yesterday may be said to have been seen by the whole trade here, by whom it has been examined with much interest.

The sample does not have the high colour of the best jute from India, but it is similar in that respect to jute which is received in large quantity from that country.

The fibre is good, possessing strength and good spinning quality. It has been very well prepared, is free from "blacks" (small pieces of bark sometimes left adhering to the fibre from want of thoroughness in preparing) and it has a good glossy fibre. The sample may be classed as medium quality of jute and quite merchantable.

The root end has not been cut off, nor what is known as "crop" at the other end been removed, no doubt in order to show the full extent of the growth as far as possible. Jute of the quality of this sample when prepared for market should be free from root and crop. It will be seen that if so treated the sample would not yield more than two feet length of fibre.

Except for the short length, there is no fault to find with the sample in comparison with jute from India of the quality with which it would be classed.

It is understood that the short length of the sample is owing to late planting and an exceptionally dry season. Taking these circumstances into consideration, the sample gives great promise that jute growing in the Gambia Colony will prove a practical success. It may be mentioned that the jute crop of this season now arriving from India is a very large one, and that the prices are exceptionally low ; but if with favourable conditions jute of the quality of the sample from Gambia can be produced, with length of fibre nearly equal to the Indian growth, there is a large future before it.

Taking one year with another, the values realised for the Indian crop have been sufficient to induce a constantly extending cultivation in that country.

You would receive along with the sample a small portion taken from a bale of Indian jute which has been sent to show the length of jute of this season's crop.

Apart from the fact that a better price per ton is realised for jute of a long growth, the bulk of produce from the land is materially affected thereby—a most important factor in the result to the producer.

It may be hoped that the trials now being made will prove that jute growing in Africa will fulfill all the conditions of commercial success.

Yours truly,
(Signed) GEO. C. KEILLER,
Secretary.

16. Beniseed (*Sesamum indicum*).—Two acres of land were placed under cultivation during the last rainy season with seed of this plant. It has grown exceedingly well. Seeds have been distributed to the headmen in British and Foreign Combo, but so far I have not heard whether the seed was utilised. The return of the crop grown on two acres at the Station from 85 lbs. of seed was 784 lbs., being nearly tenfold. There is said to be a ready demand for beniseed, and if grown in large quantities there would be a profitable return. The land was first ploughed by the oxen, then the seed sown broadcast and harrowed in. The crop was cut just before the seed vessels burst, and the plants were tied in bundles and placed on Run leaves to dry in an upright position. The seed was caught as it was expelled from the capsules. By shaking the bundles the seed is readily removed. The dry stems are then packed into a heap, and burned, so that the ash may be returned to the land as manure.

17. Indigo (*Indigofera tinctoria*).—Seeds of this were sown during last season; the plants were smaller than usual owing to the dry weather. A large quantity of seed was given away to the natives, who grow this plant for their own use. No attempt has yet been made to extract indigo for European markets.

18. Kous-kous (*Pennisetum typhoideum*).—A large quantity was grown during the past season. The yield far surpassed that of last year. The area planted was four acres. The produce is used for feeding the animals employed at the Station. The land was ploughed and the seed sown broadcast in August last. The amount of seed sown was one bushel, weighing 56 lbs., and the crop gathered was 56½ bushels, weighing 64 lbs. per bushel. The total weight of the crop was 3,616 lbs., or 1 ton 12 cwts. 32 lbs. This will be sufficient to last the animals employed here until the end of the current year. When I proceeded to England I took a small quantity of this grain with me, with a view to finding out whether there was any market for it. I was informed by the manager of Messrs. Spiller & Baker, the largest grain importers in South Wales, that the corn was imported into England, and used principally for feeding poultry, the market price then (September) being three shillings per bushel. Possibly a trade with Europe could be carried on with this grain.

RUBBER.

19. There are four different species of rubber-producing plants growing in the station. The most common species are the native rubbers (*Landolphia owariensis* and *L. florida*). These abound on the Gambia, but owing to the ruthless manner in which the trees are tapped, it is feared they will soon disappear.

20. *Hevea brasiliensis* (Para rubber).—A few plants of this are at the station, but they do not appear to be growing very well, owing to the long dry season.

21. *Castilloa elastica* (Central American rubber).—Several plants were brought out by me as already mentioned from Kew. They are now growing well, and are about two feet high. These plants are said to grow well in a deep warm soil, composed of loam and sandy clay ; a dry or rainy climate seems equally suitable, but a high and equal temperature, which does not sink below 60° F. at any time is essential.

22. *Manihot Glaziovii* yields the rubber known in commerce by the name of Ceara rubber. This plant grows well in the Colony. The only difficulty up to the present has been to procure the rubber from the tree. The sample of rubber collected from a tree growing at the station is free from impurity, but though small, it is quite large enough to show that the method of collecting I have practised is the correct one and the one which should be impressed on the local rubber collectors. The plant is very hardy, and will grow almost anywhere. Its healthy appearance in this Colony shows that it may prove of great value.

FRUITS.

23. The large orange trees in and around the station have borne an average crop of fruit this year. The flavour is very good. The young plants put out during the last rains are growing well. A large number of young plants in the nursery beds will be available for distribution during the coming rains. Some of the two-year old plants will be grafted with scions from the plants brought out from England. These are the Tangerine orange. The original orange plants brought out from Kew have been planted in tubs, and are growing well. They will eventually be transplanted into their permanent places.

24. There are many plants of the West Indian lime growing in nursery beds. These will be ready for transplanting during the rainy season.

25. Cashew (*Anacardium occidentale*).—The trees planted three years ago yielded a good crop of fruit during the year. They are looking very healthy, and are in full bloom again. The fruit is welcome, as it is in season when there is no other fruit in the local market.

26. Avocado Pear (*Persea gratissima*).—There are a number of young plants in permanent places. They are looking healthy, and appear to be growing well. The original tree is again crowded with good-sized fruits.

27. Water-lemon (*Passiflora laurifolia*).—Twenty-four plants were raised from seed and planted out. One plant only has done well, but this, I hope, will soon begin to fruit. Cuttings have been successfully rooted.

28. Sour Sop (*Anona muricata*).—One plant is growing and looking exceedingly healthy.

29. Pine-Apple (*Ananas sativa*).—The suckers of the Queen pine-apple brought from England in 1896 and planted inside the compound are looking well : some are showing fruit. There is

a considerable difference to be observed between these and the almost wild plants obtained from Sierra Leone.

30. Bananas.—The best sort of banana is that known here as the Grand Canary banana (*Musa Cavendishii*), originally from China. It is dwarf-growing, seldom exceeding five feet in height. It yields large bunches of fruit of good quality. Several bunches of fruit have been produced during the year, most of which have been sold to persons residing in Bathurst, who are glad to be able to purchase bananas at a reasonable cost. The local varieties are steadily improving under cultivation, both in flavour and size, but so far, they cannot be compared to the Chinese banana.

31. Plantains (*Musa paradisiaca*).—These are doing well and are looking healthy. Fruit has been sold during the year.

CATTLE.

32. Two extra bullocks were purchased. The animals are in good condition and do useful work. They are chiefly employed in ploughing, and are able to perform this work during nearly the whole of the dry season as well as during fine weather in the rainy season. Should a cart be added to the Station, these animals will be able to do all the hauling that is required. At present this has to be done by means of wheelbarrows and baskets.

PLOUGHS.

33. A new plough was purchased, and an exhibition of ploughing was given before the native Chiefs in Bathurst during the Jubilee festivals.

NEED FOR IRRIGATION.

34. It will be noticed that most of the crops produced here are from annuals. This is due to the long periods of drought to which the Colony is subjected every year. It would be impossible to grow other plants without irrigation. At present, if an experiment is tried during the rainy season and is unsuccessful, a whole year is lost because there is not sufficient water available for another experiment to be made during the dry months of the year. Again, some crops do not require so much water as falls during the rains, and yet they cannot be brought to perfection after the rains have ceased owing to the entire absence of moisture. Hence such plants require to be planted at the end of the rains to prevent their becoming mere leafage without fruit. With irrigation I believe nearly every plant suitable for the tropics could be grown, either at this Station or within the Colony. But with nearly eight months of drought very few plants can be expected to thrive. This question of irrigation deserves to be taken up by the Government.

FIRE BELT.

35. A tract of ground, 15 feet wide, has been cleared all round the station in case of bush fires. This precaution is very necessary, as the bush is often set on fire by the natives.

SEASONS.

36. There was practically no rain for seven months this year, and the rainy season was shorter and the rainfall lighter than for the past five years.

The following is the record of the rainfall for 1897 :—

January	nil.
February	"
March	"
April	"
May	0·12
June	1·65
July	8·11
August	10·27
September...	11·84
October	1·49
November	0·13
December	nil.
Total for the year ...	33·61 inches.

The Harmattan set in during the first week in December. It did some slight damage to the plants in the station.

37. The receipts for seeds, plants, fruits, etc., sold during the year were £14 9*s*. 2*d*.

(Signed) WALTER HAYDON.
Curator.

DXCVIII.—NEW METHOD OF DRYING VANILLA PODS.

In the *Kew Bulletin* (1896, p. 224) a note appeared giving a brief account of a method of drying vanilla pods by means of chloride of lime in course of trial at the French island of Réunion. Fuller particulars are now to hand in a report from Her Majesty's Consul, addressed to the Marquess of Salisbury (F.O. No. 1965, Annual Series, 1897) :—

Explanatory Notes as to the Drying of Vanilla by Chloride of Calcium.

The object aimed at in the treatment of vanilla, is to endow it with keeping properties, and at the same time to develop the perfume which has not yet come into being at the moment of cropping.

Pods of the best quality should be perfectly smooth, and without excrescences or holes. The longer the pods, and the more perfumed they are, without acidity, the more valuable is the vanilla.

The success of the treatment of vanilla depends upon the care bestowed upon it, and especially upon the state of maturity of the pods.

If the vanilla is picked too green, its treatment will be difficult and its keeping qualities doubtful, the pods will be thin and poor after drying, whilst the perfume will not be properly brought out, and what there is will be lacking in quality.

If plucked when too ripe, the treatment will be easy, it will be of good size and highly perfumed, but it will split and thus lose much of its commercial value.

On a well-ventilated and properly exposed plantation, the pods are ripe when the lower part begins to turn yellowish.

The treatment by chloride of calcium, $CaCl_2$, as indeed do all the other methods of treatment, consists of several operations :—

1. Stoppage of vegetation.
2. First drying and colouring.
3. Drying.
4. Watching.

1. The process of drying in a stove by means of hot water is the one resorted to. On the day of the cropping, or the next day at latest, the pods are put to dry by heat in tin cases of the following dimensions :—0·220 millimetres by 0·220 metres by 0·350 metres. Old petroleum oil tins are generally used for the purpose. The size may be slightly altered, but the width and breadth of the box should not be too large, as the vanilla in the centre should be subjected to the same heat as that which is nearest to the sides of the box. Otherwise the treatment of the pods in the centre would not be assimilated to that of those at the sides, and the resultant colouring would be slightly different.

These boxes are fitted with lids closing on the outside of the box. They are lined with wool carefully arranged along the bottom and up the sides, and a little over the top of the sides.

The vanilla pods are placed on end close enough to secure pressure without damage by rubbing ; a horizontal layer is placed on top of these, the woollen covering is folded over all and the lid put on.

The boxes thus arranged are put into the halves of wine barrels and hot water emptied into the barrels up to the lid of the boxes, care being taken that no water gets into the boxes. In order to prevent the sudden cooling of the hot water, the barrel is covered with a piece of sacking. It is left thus covered during one night.

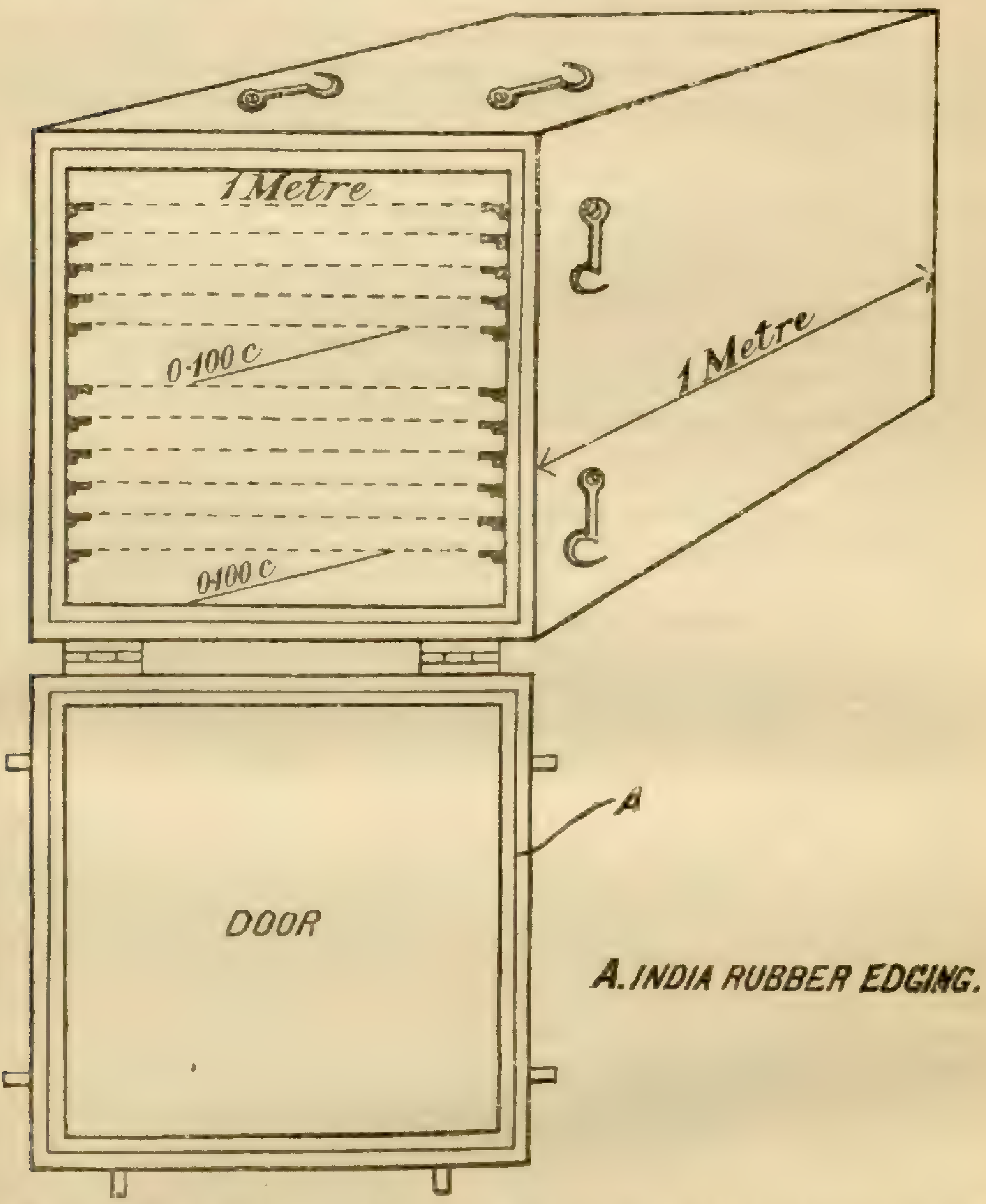
2. Next morning the pods are withdrawn and exposed in the air for some time to dry ; then for two or three days they are kept under woollen coverings in full sunlight.

For this operation low wooden boxes are used, a single layer of pods being placed in the bottom and covered with a woollen cloth. The boxes are placed in sunlight on trestles to prevent contact with the more or less moist earth. After this operation the colouring of all the pods will be uniform if the drying by hot water has been properly done.

Now is the moment to proceed to the drying operation.

3. The old methods of preparation, drying in the open air upon screens in an airy situation, or in hot-air stoves, in which the heat is constantly renewed, result in a loss of perfume and at the same time require a large amount of hand labour. These drawbacks are avoided by drying in closed vessels by means of chloride of calcium, $CaCl_2$.

This operation is carried on in boxes of galvanised iron with a hinged door and closing on an indiarubber edging to ensure air-tightness. A drawing of the form and dimensions of the box as used by the Crédit Foncier Colonial is given below :—



Each box has eleven drawers or trays ; the bottom and the sixth drawer are for the vessels containing chloride of calcium, the others are for holding the vanilla ; in the former are placed 18 kilos. of chloride of calcium, and in the latter 45 kilos. of vanilla.

The vanilla is laid upon wooden hurdle-shaped frames resting upon little brackets rivetted into the sides of the box. The tray can thus be drawn out in order to arrange the vanilla properly. Several layers are placed on each tray.

The trays should not be made of resinous or strong-smelling woods, as vanilla absorbs and retains odours it comes in contact with ; the hurdling is made of split rattans.

The vessels containing chloride of calcium should be double bottomed, the inner one being perforated to allow of the escape of the liquid chloride of calcium. Each time the case is opened the chloride vessels should be looked to, and the chloride renewed or

added to as necessary. When the trays are filled with vanilla, and the chloride vessels are in their places, the door is closed and should fit perfectly into the doorjamb. To be quite sure that the boxes are hermetically closed all rivets in the box should be soldered beforehand.

Every two or three days the vanilla is carefully examined, and any pods showing moisture are taken out and put aside to be sunned and prepared by themselves in a special box, where they are all collected.

In from 25 to 30 days the vanilla will have reached the required degree of dryness. Practice will show the exact moment when they should be withdrawn.

Vanilla insufficiently dry will not keep and breeds small worms; vanilla over-dried keeps well, but it is not supple, it is called "broken" (brisée) and has less commercial value.

4. After leaving the box, the vanilla is placed for several days on small frames in a covered and well-ventilated place, then it is removed and shut up in tin boxes, each holding from 15 to 20 kilos. of vanilla.

There it remains for several weeks, being examined every two or three days and any showing traces of mildew is carefully wiped.

When it is thought that the vanilla has reached perfection (rendue à point) and its perfume well developed, the cleaning of the vanilla is taken in hand in order to remove the dust and the germs of mildew which may adhere to it. Vanilla which is not subjected to this process is dull in colour and does not keep well.

25 to 30 litres of water at about 60° Cent. (140° Fahr.) are emptied into a perfectly clean receptacle and 15 to 20 kilos. of vanilla are thrown into it and vigorously stirred up in the water by hand.

The pods are withdrawn, lightly wiped and put to dry in the shade. In a few days when the pods are dry, they are sorted and classed according to length and quality, and made up in bundles. All these operations must be conducted with the greatest care. The bundles are placed in tin boxes with covers. Each box contains only vanilla of the same length and quality, and holds from 4 to 5 kilos. each.

Vanilla should never be sent away immediately after dealing with it. It must be watched for at least a month to be quite sure that it will keep during a sea voyage.

During the time it is being watched the boxes should be examined twice a week, and every pod showing the least trace of moisture should be withdrawn.

The mildewed pods are worked up by various processes and sold as quite inferior vanilla.

DXCIX.—DATE PRODUCTION IN BUSSORAH.

Notes on the cultivation of the Date palm in South Australia appeared in the *Kew Bulletin* (1895, pp. 161–2), and in Antigua (1896, pp. 26–28). An extract from a Report on the Trade

of the Kerman Consular District, Persian Beluchistan (F. O., 1896, Annual Series, No. 1671), with particulars of the growth of date palms in that region, was published in the *K. B.* (1896, pp. 222–223).

The following interesting "Memorandum on the Bussorah Date Season of 1897," prepared by Consul L. A. Forbes (F. O., 1898, Miscellaneous Series, No. 448), furnishes important information respecting one of the principal sources whence the dates of commerce are obtained :—

Considering the popularity of the fruit of the Date palm (*Phœnix dactylifera*), particularly among the juvenile portion of all classes in the United Kingdom, it is somewhat surprising how few even of those who have received education possess any knowledge as to the places from which the sweet and wholesome date is exported. The popular idea is generally found to be represented by a solitary palm tree near a well, or by a score of such trees in an oasis of the desert, but seldom, if ever, does it comprehend millions of acres along the banks of a magnificent river covered like a dense forest with countless palm trees. When it is considered that the palm tree and its products can be utilised for many more than a hundred different purposes by the natives of the countries where it thrives, it will be readily perceived how valuable must be the land which grows them, and how valuable must be the industry and trade connected with its culture and the export of its fruit.

The largest export of dates in the world takes place from Bussorah (Turkish Arabia), situated some 70 miles up the River Shutt-el-Arab, which is the river formed by the combined waters of the rivers Tigris and Euphrates ; other ports which compete with it in this respect are Maskat, on the western shore of the Gulf of Oman, Tangier, and some ports of Tunis.

The date season in Bussorah begins, according to the earliness or lateness of the crop, in the early or middle part of September, and lasts six or eight weeks. The crop was ready for packing this year about the usual time, viz., the middle of September.

The price is usually fixed at a meeting of the growers and buyers. This meeting or conference is generally held as soon as the dates are ready for packing, but this year it was considerably postponed with a view to obtaining reasonable terms with the owners of the dates by showing them that exporters were in no hurry, and were not eager to obtain dates at very high prices. Nevertheless, the smaller shippers and some even of the leading exporters in their great anxiety to secure their requirements and commence packing paid high prices for their dates. The first prices demanded were 340 shamis* (about £20) for "Hellawis" (the best packing date) ; 280 shamis (about £16 9*s.*) for "khedrawis" (the second quality) ; and 180 shamis (about £10 12*s.*) for "sáyers" (the inferior description) per 1 kara of 2,000 okes† (about 50 cwts.). These prices, however, do not represent the limit of rise, for 400, 300, and 200 shamis (about £23 10*s.*, £17 13*s.*, and £11 15*s.* respectively) are said to have been given for the three qualities respectively.

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* 17 shamis are equal to about £1 sterling.

† 1 oke equal to about 2¾ lbs. avoirdupois.

These high prices, it is feared, must result in loss to some shippers, for it is said that a large quantity of dates of last year still remains unsold in London and elsewhere. To maintain prices at a level necessary to obviate great loss it has been thought advisable to institute a combination in London, without which it is believed that prices would have descended disastrously low without sales being effected, owing to the flooding of the market by this year's importations of dates. The packing of the dates and the departures of the steamers were also delayed for the purpose of clearing last season's unsold stock in London and America, as well as for the object above alluded to, but buyers would seem not to have come forward, so that the stock has been little reduced.

The British firms engaged in the date trade would seem to make a great mistake in establishing combinations to maintain prices at a high figure instead of using their endeavours to push the retail sale of dates. People who are in need of dried fruits will certainly regard the relative prices of the different sorts, and, therefore, to artificially keep up the price of dates would not seem to be the best method of improving the trade in the long run, although it may have been successful for one or two seasons. It would appear that the direction in which improvement should be sought is by pushing the retail sale, and by taking into greater consideration the local changes which have taken place in regard to the increase of native packers, the attitude of the native growers and practices which were suitable and advantageous years ago, but of which altered circumstances may demand their partial or total abandonment, and the substitution of others more beneficial to the British exporting firms.

The quality of dates this season is said to have been exceptionally good, although the quantity was somewhat less than last season, owing to excessive heat about the time the crop was entering into the ripening stage which caused the fruit to dry up and fall. Some gardens were also affected by blight, which caused much fruit to drop off before being matured. It is said that about 750,000 cases of ½ cwt. each were shipped from Bussorah for London, New York, and other places. Maskat is said to have exported 60,000 cases. Besides the shipment of dates in boxes a large quantity is exported in baskets to India and its dependencies. These dates are generally of the inferior qualities and are transported in native sailing craft.

It would seem that the packers of dates were more or less obliged to ship as many cases as they possibly could, seeing that there were at the beginning of the season 1,000,000 empty boxes which had been paid for, the smaller packers not being in a position to be able to hold over empty paid-for boxes to the next season; and seeing also that considerable advances of money had been made to packers who were thus enabled to pack more dates than their own limited capital, without such advances, would have permitted them to pack; large advances to the growers against their dates when ready for packing had also been made. It must also be observed that packers had incurred sundry not inconsiderable expenses in the erection of packing sheds, and were presumably induced to make these preparations for packing

as many dates as possible by the comparatively fair prices which were obtained last year for the first arrivals of dates in London, while they seemed either to forget, or fail to take into consideration, the considerable quantity remaining unsold from last year's shipments. So eager and impetuous were some of the minor native shippers to obtain as many dates as they could that, it is related, they have parted with their wives' jewellery even in their hot haste to secure as much profit as possible. But looking at the state of the date market in London, which has already been adverted to above, there would seem to be very little room for doubt that many will repent their rash and ill-judged speculation.

It may be generally said that the culture of the date palm in the Turkish province of Bussorah has steadily increased since the packing of dates in boxes for export to the United Kingdom and America was started, which is about 15 years ago. In the year 1896 the greater part of the country was inundated by unprecedented floods, in which it is reported over a million date palms were destroyed; these trees, it is believed, have been all replaced by young ones, but still it will take 6 to 10 years before the latter produce fruit in any quantity. The high prices which are now obtained by the growers for their dates have rendered the possession of date gardens most valuable property, and the culture of the date palm receives from the Arabs great care, attention, and expenditure of capital in manuring and irrigation, which is not the case with land under any other form of produce.

It may be interesting to note that one of the uses to which the date has been applied is the manufacture of vinegar. A company was formed for the purpose, but there is no information available as to its success or otherwise. It seems, however, to have affected no appreciable difference in the demand for dates.

Until France imposed a prohibitive duty, dates in baskets used to be imported into that country for distilling purposes. At present she imports an inconsiderable amount of dates.

It might be worth while giving the date a trial for making whisky, as "arak," the cheap native liquor of the country, is distilled exclusively from dates.

Lastly, it may be observed that the date business of Bussorah does not possess very bright prospects, although British capital employed in it has shown, and may show this year, good returns; nevertheless, there are circumstances connected with it, briefly touched upon in this memorandum, which demand the consideration of the British firms, and which may detrimentally and permanently influence their share in it.

The consumption of dates seems to have been on the decline, for which there may be many reasons, but perhaps it may be primarily ascribed to other dried fruits, such as currants, raisins, and figs, being procurable at a cheaper rate, and it would therefore seem to be a mistake to bolster up the price of dates by combinations which will certainly not tend to augment the demand for them. The large annual shipments serve only to glut the market, while no signs of an increasing demand are apparent. The demand for dates must be dependent to a very considerable extent on the supply and price of other dried fruits, and it has

been said that a total failure of the Bussorah crop would not raise the price of dates 25 per cent. if other dried fruits were an average crop. On the other hand the expenses connected with buying, packing, and shipping the dates to England are so large that, unless a certain price is obtained for them, loss must ensue.

The native growers for the last two years have demanded and received much higher prices for their dates, and they will be likely to hold out in future for equally high, if not higher, prices, on one pretext or another. Combinations of packers to limit the price to be paid for the dates, or to limit the number of boxes to be shipped, or to abandon the custom of giving advances to the growers, seem to be impotent in effecting any good owing to the unreliableness and untrustworthiness of some of their number. The practice of making considerable advances to small packers, who are thus enabled to swell the shipments far beyond the requirements of the market, should be kept within very narrow limits, if not abolished altogether. As a final observation, it may be said that probably the best thing for the date business in Bussorah, as regards the interests of the British firms, would be if the small packers were to suffer a severe blow which would drive them to an abandonment of it.

DC.—BERMUDA ARROWROOT.

A summary of information respecting the important arrowroot industry carried on in the island of St. Vincent was published in the *Kew Bulletin* (1893, pp. 191-204 and p. 360). Queensland and Grenada arrowroots were discussed in the same volume (pp. 331–333), and South Australia arrowroot two years later (*Kew Bulletin*, 1895, pp. 100–101).

Hitherto no authentic account had been available of the interesting arrowroot industry carried on in Bermuda. This colony does not export a large quantity (about 500 to 700 kegs yearly), but it is always admitted that the produce is of the finest quality. The prices, in 1893, ranged from 2*s*. 2*d*. to 1*s*. 3*d*. per pound, while good St. Vincent only fetched 3¾*d*. to 6*d*. per pound. At the present time St. Vincent arrowroot has fallen still lower, and some sorts are unsaleable at almost any price.

It is evident that one reason for the superior character of Bermuda arrowroot is the scrupulous care taken in every state of the manufacture. Added to this, the water is extremely pure. The only particulars obtainable of the industry are contained in the *Report of the Commissioner of Agriculture*, U.S.A., for the years 1881–1882, p. 226. As they may be of service to many colonies where arrowroot is cultivated, they are reproduced below :—

"The island of Bermuda has the reputation of producing superior arrowroot. The mode of culture adopted is very similar to that practised in the culture of the common potato. The ground is well manured and ploughed deep. It is then harrowed and laid out in drills about 6 inches in depth and 3 feet apart. In these drills the roots are set about 8 inches apart, covered

with the plough, and the surface smoothed by harrowing. The plants require a whole year to mature, and economical planters set the drills somewhat wider apart and introduce an intermediate row of the potato, the crop of which is ready for removal before it can injure the arrowroot crop. Sometimes Indian corn is planted in these alternate rows, which is cut for forage while green ; if allowed to mature the main crop would be impaired by it.

"The mode of preparing the fecula from the roots greatly influences its value, and the superiority of the Bermuda article is attributed to the extreme care and cleanliness exercised in the processes of manufacture.

"The roots, after being collected, are washed and their outer skin completely removed. This process has to be performed with great nicety, for the cuticle contains a resinous matter which imparts colour and a disagreeable flavour to the starch which no subsequent treatment can remove. After this process the roots are again carefully washed and then crushed between powerful rollers, which reduces the whole mass into a pulp ; this is thrown into large perforated cylinders, where it is agitated by revolving wooden paddles, while a stream of pure water carries off the fecula from the fibres and parenchyma of the pulp and discharges it, in the form of milk, through the perforated bottom of the cylinder, from whence it is conveyed in pipes and passed through fine muslin strainers into large reservoirs, where it is allowed to settle and the supernatant water drawn off.

"After being repeatedly washed, it is allowed to settle for some time, when the surface is skimmed with palette knives of German silver, in order to remove any slightly discoloured particles which may appear on the top, retaining only the lower, purer, and denser portion for drying for market.

"The rollers and cylinders are made of brass and copper, so as to preserve the purity of the material.

"The drying is conducted with equal care and cleanliness. The substance is spread in flat copper pans and immediately covered with white gauze to exclude dust and insects. These pans are placed on rollers and run under glass-covered sheds when there is any danger from rains or dews. When thoroughly dry it is packed with German-silver shovels into new barrels ; these are first lined with paper, which is gummed with arrowroot paste.

"The barrels are exported on the decks of vessels under cover ; if placed in the hold the arrowroot might be tainted by the effluvia of other freight. Such are the processes employed and the care bestowed in the preparation of arrowroot in Bermuda."

DCI.—FAMINE PLANTS IN ZULULAND.

The following correspondence communicated to Kew by the Secretary of State for the Colonies affords an interesting account of wild plants that were utilised as a main source of food supply by the natives of Zululand during a recent period of scarcity. None of the plants appear to possess any special merit

beyond the fact that they withstand prolonged drought, are accessible and have no marked deleterious properties. The principal parts used are the leaves boiled and eaten as a spinach. There are numerous berries, and a few bulbs and roots.

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, November 25, 1897.

I am directed by the Secretary of State for the Colonies to transmit to you, for your information, the accompanying copy of a despatch from the Governor of Zululand, enclosing a list of food plants eaten by the natives, which formed the main source of food supply during the recent period of scarcity.

I am, &c.,
(Signed) Fred. Graham.

The Director,
Royal Gardens, Kew.

The Hon. Sir Walter Hely-Hutchinson to Colonial Office.

Government House, Pietermaritzburg,
Sir, Natal, October 27, 1897.

The scarcity of food in Zululand, due to drought, and to the ravages of locusts, in 1896, was particularly severe in the Ubombo District. Owing to the remoteness of the district, and to the presence of the Tsetse fly on a part of the route thither, the difficulties in the way of transport were great, and the demand for "relief" mealies (maize) exceeded the supply which it was possible to provide. Notwithstanding, although there was a good deal of suffering, there was not, so far as is known, a single death from starvation. Leave was given to the natives to kill all the game they could, but the main source of their food supply appears to have been the seeds, fruits, leaves, and roots of the plants which grow wild in the bush. I have had specimens of these plants collected, and (as far as has been possible) identified by Mr. Medley Wood, A.L.S., the Curator of the Durban Botanic Garden. The list which I enclose may be of interest to the authorities at Kew.

A Natal colonist of long experience, to whom I mentioned this matter, said to me: "So long as there is rain enough for the wild salads and spinaches to grow, the natives, although they may suffer from want of food, will never actually starve." It is to be feared, however, that under such circumstances there must always be a large increase in infant mortality.

I have, &c.,
(Signed) Walter Hely-Hutchinson.

The Right Honourable
Joseph Chamberlain, M.P.,
&c., &c., &c.

(Enclosure).

Specimens of Plants and Fruits used by Natives of the Ubombo District in Zululand as Food During Times of Scarcity.

No.	Zulu Name.	Botanical Identification.	Remarks.
1	Icena	Aloe Cooperi, *Baker* . .	The inside of the stalk is scooped out and cooked
2	Umkwapa ...	Strychnos Gerrardi, *N. E. Br.*	The inside of this fruit, without the seeds, is roasted.
3	Umganu	Sclerocarya caffra, *Sond.*	The fruit of this tree is made into beer. Pulp also eaten in Natal.
4	Isisimbi	Cucurbitacea	The leaves are cooked as a spinach with other herbs.
5	Idedelanyati ...	Leucas sp.	Leaves used as a spinach.
6	Umhlonyana ...	Leucas glabrata, *Br.* ...	Leaves used as a spinach.
7	Isinongwe ...	Hypoxis filiformis, *Baker.*	The roots of this plant are boiled and eaten.
8	Izibo	Nymphæa stellata, *Willd.*	A water lily. The tuber is boiled for a short time. Also eaten by Natal natives.
9	Matandana ...	Niebuhria nervosa, *Hochst.*	The fruit of this plant is eaten.
10	Igegetyhana . .	Cephalandra	Fruit eaten.
11	Iloba	Scilla, probably S. lanceæfolia, *Baker.*	The bulb is cooked.
12	Umqokolo ...	Aberia caffra, *Hk. and Harv.*	A thorny tree; fruit eaten.
13	Mcavusana ...	... ...	A tree, the berries of which are eaten.
14	Intangamana ...	Commelina sp.	A plant; leaves eaten.
15	Isankuntshana ...	Ophioglossum capense, *Schl.*	A small plant; leaves eaten.
16	Iviyo	Vangueria infausta. *Burch.*	A small tree; fruit eaten. Also eaten in Natal by natives and colonists.
17	Umpela	Strychnos (?)	The berries of tree eaten.
18	Uguguvama ...	Lantana salviaefolia, *Jacq.*	A small plant, the berries of which are eaten.
19	Amatunduluka ...	Ximenia caffra, *Sond.*...	A tree: the fruit eaten. Seeds contain oil.
20	Untshungu ...	Cucurbitacea	A creeper; the leaves make a spinach.
21	Matsana	Aizoon canariense, *Linn.*	A small plant; leaves eaten.
22	Isihlaza	Celosia trigyna, *Linn.*...	Leaves and flowers eaten.
23	Umpema	... ...	The same, I think, as No. 18.
24	Mabelebela ...	Sarcostemma viminale. *R. Br.*	Stems and fruit eaten. Commonly eaten by native women and children in Natal.
25	Ugwapa	Riocreuxia torulosa, *Dcne.*	Small plant; leaves eaten.
26	Isendelendtya ...	Cucumis sp.	A creeper; fruit eaten.
27	Isankuntana ...	Ophioglossum reticulatum, *Linn.*	Small plant, leaves eaten.
28	Ixabaxaba ...	Solanum nigrum, *Linn.*	Leaves eaten, also berries.

SPECIMENS OF PLANTS AND FRUITS—*continued.*

No.	Zulu Name.	Botanical Identification.	Remarks.
28	Bis...	Sonchus oleraceus, *Linn.*	Leaves eaten, also berries.
29	Izintondo ...	Argyrolobium marginatum, *Bolus.*	A small plant; the roots eaten both cooked and uncooked.
30	Utshwalabenyoni	Cucurbitacea	A creeper; leaves eaten.
31	Ibigicana	Chenopodium ambrosioides, *Linn.*	Leaves cooked and eaten.
32	Umkuhlo ...	Trichilia dregeana, *E.M.*	A large tree; fruit eaten. Seeds contain oil, which is used occasionally by natives in Natal.
33	Ubukobe	Leguminous plant, indeterminable	A small plant; roots cooked and eaten.
34	Umsobe	(Not in Box)	Berries of plant eaten.
35	Makukutwana ..	... .	A creeper; leaves eaten as spinach.
36	Umgxele	Ehretia hottentotica, *Burch.*	A tree, the berries from which are eaten.
37	Umbilibili ...	Lycium acutifolium ...	A small plant; the leaves eaten.

(Initd.) W. H. H.,
October 29, 1897.

DCII.—MISCELLANEOUS NOTES.

THE DIRECTOR has been appointed a Royal Commissioner for the Paris Exhibition of 1900.

MR. WILLIAM HENRY JOHNSON, a member of the gardening staff of the Royal Gardens, and formerly in the employ of the Marquess of Salisbury at Hatfield House, has been appointed, by the Secretary of State for the Colonies on the recommendation of Kew, Acting Curator of the Botanic Station at Aburi during the absence on leave of the Curator, Mr. C. H. Humphries, from the Colony. Mr. Johnson left for the Gold Coast on the 19th January last.

SIR GEORGE KING.—The posts of Superintendent of the Royal Botanic Gardens, Calcutta, and of the Government Cinchona Plantations at Mungpoo, were vacated, on February 28, by Brigade-Surgeon Lieut.-Colonel Sir George King, K.C.I.E., F.R.S., who had held them since 1871. He had previously been advanced in the Order of the Indian Empire in the New Year's Gazette.

The success and brilliancy of Sir George King's administration of his arduous and difficult posts has commanded equal admira-

tion in India and at home. He has practically remodelled the landscape effects of the famous Gardens under his charge. He rebuilt the Herbarium building on lines somewhat similar to those adopted at Kew, and, by his personal indefatigable energy, made it one of the great botanical collections of the world. He loyally supported Sir Joseph Hooker in the preparation of his vast undertaking, the *Flora of British India*, by the copious supply of specimens, drawings, and other material. On his own account he initiated the splendid series of the *Annals of the Royal Botanic Gardens*, Calcutta, which supplements the *Flora* by fuller descriptions and life-size figures. Seven volumes have been issued by the Government of Bengal, whose enlightened support Sir George King has never failed to enjoy.

In his admininistration of the Cinchona Plantations, Sir George King has had to overcome great technical difficulties before he was able to realize the original design of the Government to supply the people of India, on a self-supporting basis, with quinine at a nominal cost. This was finally effected in 1893, and a dose of five grains of quinine can now be purchased at every local post office for a pice, or about a farthing.

The following extract from Sir George King's Annual Report for 1892–3 describes this momentous event in his own words :—

"*Sale of quinine at post-offices.*—The chief event of the year has been the organization of the system by which quinine, made up in doses of five grains, is offered for sale at most of the post-offices within the Province of Bengal. Each dose is made up in a neat closed paper envelope, and is sold for one pice. Each packet carries the royal arms as a guarantee of genuineness, together with brief instructions in the vernacular. To encourage the post-office officials to push the sale of these packets, a small commission is allowed, and considerable facility is offered for replenishing of stocks by post-masters ; the parcel-rates for transmission, however, bear rather heavily on the scheme, and I trust some means of lightening them may soon be found. When the scheme was suggested last year, it very soon became obvious that one of the first conditions of success would be to find some means of making up the packets by which adulteration and loss from pilfering and careless weighment might be reduced to a minimum. It was therefore decided by Government to make this matter over to the Jail Department. The quinine is therefore made over from the factory to that department in bulk, and by prison labour it is sub-divided into pice packets, 1,400 of which go to each avoirdupois pound. The Jail Department distributes these packets to the post-masters, and collects the proceeds of the sales at the various post-offices. A dose of pure quinine is by this means put within the reach of any person within the province who has a pice to buy it with. Thus at last, after thirty years of effort, has the end been attained which the Government set before itself when the growth of the medical cinchonas was begun in British India. That end was thus expressed in an early Government resolution on the subject :—'To put the only medicine that is of any use in the cure of the commonest and most fatal of Indian diseases within the reach of the poorest.'"

The following extract from the *Indian Forester* (vol. xx., p. 81) gives the result for the first year :—

"A few months ago, we published a short account of the new arrangements by which quinine is sold at post-offices in Bengal, the Central Provinces and elsewhere, in small packets at 1 pice each. Our readers may be interested in the following figures, showing the value of sales during 1893 :—

	Rs.
January	189
February	177
March	207
April	330
May...	523
June	872
July...	1,305
August	3,399
September	1,990½
October	3,045½
November	4,262
December	3,402
Total Rs. ...	19,702

"The number of packets actually sold was 1,446,900, which is not bad for the first year, and shows that the new scheme has 'caught on' and bids fair to be a great success."

This result could not have been achieved without the "fusel oil process of manufacturing quinine," of which the history is given in the *Kew Bulletin* for 1890, pp. 31–34. This was devised by Mr. C. H. Wood, formerly Quinologist to the Government of Bengal, with the aid and information obtained by Sir George King during a visit to Holland in 1887. The processes formerly in use in India, now in great measure superseded, are described in Sir George King's "*Manual of Cinchona Cultivation in India*" (1876).

A scheme for a botanical survey of India was promulgated by its Government, February 26, 1891, and Sir George King received the official title of its "Director." In this capacity he commenced in 1893 the publication of "*Records of the Botanical Survey of India*." Of this, eight numbers have at present been issued.

Sir George King has been succeeded in his various functions by SURGEON-MAJOR D. PRAIN, M.B., F.L.S., F.R.S.E., a distinguished Indian botanist, who for some years has assisted him as Curator of the Calcutta Herbarium.

In 1888, Sir George King was entrusted by the Government of the Straits Settlements, with the approval of the Secretary of State for the Colonies, with the preparation of a "*Flora of the Straits Settlements and Malay Peninsula*." He has published from time to time in the journal of the Asiatic Society of Bengal successive papers, ten in all, entitled "Materials," for this important work. It is to be hoped that Sir George King's enforced leisure may enable him to complete it in a definitive form.

The post of Government Botanist and Director of Cinchona Plantations to the Madras Government was rendered vacant by the death of Mr. Lawson in 1896.

It has now been decided by the Government of India to separate the two appointments. Mr. W. M. STANDEN has been confirmed in that of Manager of the Cinchona Plantations for five years. That of Government Botanist has not as yet been filled up, Dr. Bourne, the Professor of Biology at the Presidency College, having acted in the meantime. The Herbarium and Botanical Library have been transferred to the custody of the Superintendent of the Government Central Museum, Madras.

By the death of PROFESSOR THOMAS KIRK, on March 8, after a short illness, Australasia has lost another distinguished botanist. Of Scotch extraction, Professor Kirk spent the greater part of a long life in New Zealand. For some time he held the position of Chief Conservator of State Forests to the Government of New Zealand. His *Forest Flora of New Zealand* (1889) is a classical work which will always maintain his reputation as a botanist, and remain as a splendid record of his official services. Latterly Professor Kirk has been occupied with a revision of Sir Joseph Hooker's *Handbook of the New Zealand Flora*, in which would have been incorporated the results of further research on native New Zealand plants since its publication in 1867. For this purpose Professor Kirk was in constant communication with Kew, where the types described by Sir Joseph Hooker are preserved. Unhappily he has left it little more than half finished. A letter received from Professor Kirk, dated February 17, did not reach Kew till after the news of his death. But it conveyed no intimation of failing health.

MR. FREDERICK ENOS WILLEY, Curator of the Botanic Station at Sierra Leone, died January 18. The Governor, Sir Frederick Cardew, writing under date January 22, to the Secretary of State for the Colonies, recorded his appreciation of the services rendered to the Colony by Mr. Willey in the following terms :—

EXTRACT from letter from Governor of Sierra Leone to Colonial Office, dated January 22, 1898.

"I cannot speak too highly of the valuable services which Mr. Willey has rendered to this Colony, not only as regards the Botanical Gardens, the creation of which is due entirely to his skill, ability, and energy, but also in promoting an interest in agriculture and gardening on the part of the community, and I fear that he met with his death in the furtherance of this end, for at the time he contracted the fever he was engaged in inspecting farms in order that prizes might be awarded for the best cultivated ones at the approaching Agricultural Exhibition.

"Mr. Willey was a conscientious and good officer, and devoted to his work."

An account of the station (with a plan) was given in the *Kew Bulletin* of last year (pp. 303–317.)

Mr. Willey's death was totally unexpected. The most recent news of him and his work is contained in the following letter to a member of the Kew staff from Mr. Louis Gentil, whose appointment as Agricultural Expert to the Government of the Congo Free State was recorded in the *Kew Bulletin* for last year (p. 333) :—

On board s.s. "Coomassie,"
October 22, 1897.

On the 20th of this month at 8 o'clock a.m., the Sierra Leone chain of hills appeared in sight. What a difference between the arrival on the West Coast of Africa and the Canary Islands ! In Africa it is marvellously beautiful and the vegetation runs down to the very sea ; in Grand Canary a few green spots (Banana cultivations), houses flat-roofed, and hills of volcanic sterility. Our ship anchored about a mile from the shore, and after the sanitary visit of a native doctor, the ship was invaded by crowds of black men. About 80 were engaged by the captain in order to work the cargo out of the ship at the Congo. Other natives came on board by small boats and did their best to get passengers to have a run on shore. Still, by playing with feet and elbows I managed to find a suitable place in a small boat with a young native of Sierra Leone, who promised to pilot me through Freetown. Before arrival, I had carefully read the October number of the *Kew Bulletin*, and knew that if I could reach Pademba Road, I would not be long before finding the Curator's house at the station. Funny are the impressions a man gets when setting foot for the first time on the black continent. Some of the natives are lying down lazily, others going on slowly with a big basket or a pot on their head, others comfortably carried in a hammock. The roads and the streets are not paved nor asphalted but covered with a nice verdure where a species of little sheep feeds. You meet black people dressed in the last European fashion, some others in variegated colours, and others again *a la Monsieur Adam*. Arriving in Pademba Road, I inquired at a bazaar shop where I could find the Botanic Garden, and immediately the shopkeeper showed me a church close to the gate of the garden. I reached the gate (a fine one) and followed a splendid main path bordered with beds planted with Crotons, Acalyphas, Amaryllis, Roses, Cannas, &c. A man was cutting the grass in the lawn with a machine ! I am in the Botanic Garden, no doubt about it. I go on, the *Kew Bulletin* plan in hand, and find a fine house before me. Silence reigns everywhere. I must say it was about 11.30 a.m. Mr. Willey do I shout ; no answer. Mr. Willey I again shout a little more loudly, and directly an answer comes from the first landing. A nigger arrives and shows me the way up. I find myself in a spacious room lighted by over a dozen large windows. Willey is there in good health. What a splendid view from the house ! Willey saw the ship coming to the harbour, but he was not sure if I would be there. While talking of Kew, its official and gardener friends, I am sponging my poor head to cool it. There we lunch with good appetites, and I eat for the first time the unripe fruit of *Carica Papaya* as a vegetable.

In taste, colour and appearance it does not differ much from the vegetable marrow. After that we agree to facilitate digestion by a walk through the garden. As far as I know, and from what I have seen there is not much in Sierra Leone as regards gardens, and I was surprised to find such a beautiful one as Willey's. What captivates the attention of an European visitor is to find there in flower the majority of our favourite garden plants such as dahlias, roses, cannas, zinnias, fuchsias, besides African species: musas, coffeas, *Cocos nucifera*, *Carica*, &c., and also the favourites of our continental glasshouses: *Allamanda*, *Bougainvillea*, *Russellia juncea*, *Tecoma stans*, *Thunbergia erecta*, *Poinsettia*, *Lantana*, *Acalypha*, *Croton*, &c. Here is a list of plants I saw in flower in the Botanic Garden ; I am taking them as they occur in my pocket book : *Tabernæmontana coronaria*, *Pancratium?* *Ipomœa Quamoclit*, *Salvia coccinea*, *Solanum Melongena*, *Tecoma stans*, *Vinca rosea* and *V. rosea-alba*, *Datura suaveolens*, *D. chlorantha*, *Impatiens*, *Jasminum Sambac*, *Lantana horrida*, *Meyenia erecta*, *Ixora Fraseri*, *Acacia farnesiana*, *Amaranthus* (different ones). *Acacia Catechu*, *Clitoria ternatea*, *Aristolochia elegans*, *Capsicum annuum*, *Bixa Orellana*, *Barleria* (the same as I had in 17a, at Kew, fl. pale blue), *Bryophyllum calycinum*, *Ixora maxima*, *Hibiscus vitifolius*, *Gloriosa superba*, *Thevetia neriifolia*, *Hippeastrum equestre*, *Melia sempervirens*, *Acidanthera æquinoctialis*, *Allamanda Hendersoni* and *A. neriifolia*, *Alstonia macrophylla*, *Clerodendron fallax*, *Abroma augusta*, *Begonia sp.*, any amount of Cassias (*florida*, *Fistula*, *alata*, *occidentalis*, *glauca*, *alba*), *Sesbania grandiflora*, *Poinsettia pulcherrima*, *Nerium Oleander* (splendid), *Spathodea campanulata*, *Psoralea pinnata*, *Petiveria alliacea*, *Bauhinia megalandra*, *B. variegata*, Cannas, roses, *Cæsalpinia pulcherrima*, *Plumbago capensis alba*. In the tank : *Nymphæa Lotus* and *N. stellata*.

There is a plant, a *Lantana* with spines (*horrida?*), a species from the Cape, which makes a pretty border about one or two feet high and covered with flowers. I saw also several wonderful specimens of the Cashew-nut trees (*Anacardium occidentale*) giving plenty of shade and at the base of which Willey has established a fernery composed of wild species. A few orchids are also placed on the trees. I noticed also a tree about 65 feet high, covered with bright scarlet flowers (*Spathodea campanulata*). Amongst other really remarkable trees in the garden were the rain tree (*Calliandra Saman*), *Melia Azadirachta*, two giant specimens of *Adansonia digitata*, *Poinciana regia*, *Achras Sapota*, the Jack-fruit (*Artocarpus integrifolia* ; in fact, it was a fine lesson to me, that visit to one of the West African Botanic Stations. The nursery especially interested me with its peculiar way of shading either with an interplanting of banana trees or by roof of dried palm leaves, about three feet from the ground. I saw there many of the Kew seeds given to Mr. Willey on his last return germinating freely, also thousands and thousands of *Kickxia africana*, and at least 20,000 *Coffea liberica*. What a beautiful tree is the Sierra Leone coffee (*Coffea stenophylla*), with its bushy appearance, small leaves and pretty berries. Willey showed me a plant of *Manihot Glaziovii* which had been sown twenty months ago, and has reached in such a short time twenty feet in height ; what a very great amount of rain does that colony get. Along the beautiful walks laid out

with so much care there are holes four and five feet deep made by the heavy rains. Even the bridges built over the stream have suffered.

Excuse my adding that while I landed on a dreadfully hot day, which made me perspire like a ship fireman, I had the opportunity to see the Sierra Leoneeses (female) in their pure beauty. What a beautiful colour of skin they have; it is not black, but a pale brown chocolate.

The captain of the "Coomassie" advised he would leave Sierra Leone at 3 p.m., so that Willey and I took the way down to the harbour in time to catch her. Along the street at the front of the houses any amount of strong plants of *Acalypha*.

Now we are going at full speed towards Boma, about 1,600 miles from Sierra Leone, without making any other calls on the way. The distance between Antwerp and Boma is 5,000 nautical miles. If we reach the Congo on the 30th we shall be glad.

Believe me, &c.,
(Signed) LOUIS GENTIL.

BOMA, November 2, 1897.

At last! Everything is done, all is settled! The "Coomassie" arrived at Banana on Friday last at 2 p.m. It anchored there until the next day, 6 p.m. We arrived at Boma at 3 p.m. The authorities there gave me a bed and a pair of covers. The following day was a Bank holiday and so was the Monday, so that tired and suffering from the action of that wonderful sun I was lying down nearly all the day long. To-day I had to present myself to the General Secretary, who introduced me to the Governor. Both were charming men. After many questions about my studies both at home and abroad, they decided to give me the direction of the principal, healthiest and most extended coffee and cocoa cultivation of the Free State—I mean the equator. So that next Thursday I shall leave Boma in order to reach Equateurville about the middle of December. From Boma I travel by steamer to Matadi; from Matadi to the river l'Inkissi by railway (?) From l'Inkissi to Leopoldville six or seven days' walking. From Leopoldville to Equateurville (my future residence) by steamer. Beside my own boy I have six men to carry my luggage and four men for the bed, stores, canteen, water, &c. Next December I shall be under a vertical sun. As I promised you, my next letter will give you my impressions of two months of superintendence of the Government Plantations at the equator.

The banks of the Congo from Matadi to Boma are beautiful, I may say, just as nice as the Sierra Leone coast, but here at Boma it is very poor indeed.

Believe me, &c.,
(Signed) LOUIS GENTIL.

Botanical Magazine for February.—All the plants figured are in cultivation at Kew. *Richardia elliottiana* was raised from South African seeds by Mr. Knight, gardener to Captain Elliott, of

Farnboro' Park, Hants, in 1886 (not 1896, as misprinted in the Botanical Magazine). The Kew plant was obtained from Messrs. James Veitch & Sons, of Chelsea, in 1894. It has bright golden-yellow spathes. *Paphiopedilum chamberlainianum*, a Sumatran species, is well known under the name of *Cypripedium chamberlainianum*, and was introduced by Messrs. Sander & Co. *Daphne blagayana*, native of the Carinthian Alps, has very fragrant, nearly white, flowers, which are produced in March. It was brought into cultivation by Messrs. Veitch about 20 years ago. *Dasystachys Drimiopsis*, a liliaceous plant from South-east Tropical Africa, was brought to Kew by the late Mr. John Buchanan, in 1892. The small, white flowers are borne in a dense raceme. *Anemone vernalis* is allied to the British *A. Pulsatilla*. The plant figured was collected in Switzerland by Mrs. Thiselton-Dyer, in 1895.

Report on Economic Resources of West Indies.—As stated in the *Kew Bulletin* for last year (p. 339), the Secretary of State for the Colonies expressed the wish that the Memorandum on the "Agricultural Resources and Requirements of British Guiana and the West India Islands," which was appended to the report of the West India Royal Commission, should be issued in a more convenient form. It has accordingly been issued as an additional volume to the *Kew Bulletin*, with the following prefatory note by the Director :—

"The West Indies possess a large extent of fertile soil, as well as a varied and favoured climate. No part of the earth's surface seems destined by Nature for a happier prosperity. That condition is, unhappily, not realized. Their condition is far from flourishing. Occupying an area nearly as large as that of the British Isles, little more than 2 per cent. of it is cultivated at all, and only 7 per cent. of that which admits of cultivation. Yet they are capable of producing every kind of tropical produce, and in the temperate countries of the New World possess a ready and ample market. For at least a hundred years past no effort has been wanting on the part of the home Government to supply them with plants from all parts of the world which would form the foundation of cultural industries.

"To examine the causes of their present distress, Her Majesty the Queen was pleased, in December, 1896, to appoint a Commission of Enquiry, composed of men of exceptional ability and experience. With the assent of the Lords of the Treasury and of the First Commissioner of Her Majesty's Works and Public Buildings, the Assistant-Director of the Royal Gardens, Kew, was attached to the Commission as 'Expert Adviser in Botanical and Agricultural questions.' The Commission proceeded to the West Indies in January of last year, and issued its report in the following autumn.

"To this report the document reprinted in the present volume was added as an appendix. It was drawn up by the Assistant-Director for the use of the Commission. Dr. Morris's residence

in the West Indies, his repeated visits to them, and his intimate knowledge of their conditions, have enabled him to produce an account as accurate as it is impartial of their natural and economic resources, which is certainly more complete than anything hitherto available. Why the West Indian Colonies have failed to reach success, and in what direction the path to it lies in the future, can be readily understood by anyone who will take the trouble to read these pages.

"At the conclusion of their report the Commissioners bear testimony to their value in the following terms :—

"'We have had in the course of this report to refer frequently to the very interesting and valuable survey supplied by Dr. Morris of the agricultural resources and requirements of the Colonies visited by us, which forms Appendix A. in this volume. Dr. Morris' presence with the Commission has been of great advantage to us; no adviser could have been assigned better qualified, both by general and local knowledge, to assist and inform us in regard to botanical and agricultural questions. The Report which he has prepared bears witness to the closeness of his study of these questions, and the assiduity with which he has collaborated throughout the course of our inquiry to further the purposes of the Commission.'"

"The Secretary of State for the Colonies having desired that this Appendix should be issued in a more accessible and convenient form, it was eventually decided that this should be done in connection with the *Kew Bulletin*, the pages of which contain a large mass of information cognate with the subjects enquired into by the Commission.

"The opportunity has been taken to carefully revise it. Under each Colony a brief account has been added within brackets of its botanical organisation, as well as lists of books and papers which may be consulted for further information.

W. T. T. D.

Kew, January, 1898."

Work from Jodrell Laboratory.—During the current session of the Royal Society the following communications have been made to it relating to work carried on in the Jodrell Laboratory :—

November 18, 1897.

Note on the Influence of very Low Temperatures on the Germinative Power of Seeds. By Horace T. Brown, F.R.S., and F. Escombe, B.Sc., F.L.S. (*Proc. R.S.* vol. 62, pp. 160–5).

Seeds of 12 species were subjected for 110 hours to the temperature of liquid air (– 183° C. to – 192° C.), and afterwards allowed to germinate side by side with seeds which had not been so treated. Perfect plants developed in both cases, similar in all respects. Since no metabolic changes are possible at these low temperatures, the authors conclude that there are none in resting seeds, although these still retain potentiality of life.

On *Spencerites*, a new Genus of Lycopodiæceous Cones from the Coal-measures, founded on the *Lepidodendron Spenceri* of Williamson. By D. H. Scott, M.A., Ph.D., F.R.S., Hon. Keeper of the Jodrell Laboratory, Royal Gardens, Kew (*Proc. R.S.* vol. 62, pp. 166–8).

The sporophylls are of peltate form, consisting of a short cylindrical pedicel, expanding into a relatively large lamina. The sporangia are approximately spherical bodies; unlike those of *Lepidostrobus*, they are quite free from the pedicel, and are attached by a narrow base to the upper surface of the lamina, where it begins to expand.

March 3, 1898.

On the Depletion of the Endosperm of *Hordeum vulgare* during Germination, by Horace T. Brown, F.R.S., and F. Escombe, B.Sc., F.L.S. (*Proc. R.S.*, vol. 63, pp. 3—25).

The authors investigated the relative *rôles* of embryo and endosperm in the depletion of the latter during the germination of *Hordeum vulgare* var. *distichon*. They came to the conclusion that there is no evidence of any vital activity in the amyliferous part of the endosperm during this process, but that some amylohydrolysis, and the principal part of the cytohydrolysis, is to be ascribed to that peripheral part of the endosperm known as the "aleurone-layer."

The embryo was shown to have marked amylohydrolytic, but very feeble cytohydrolytic power.

It is suggested that one function of the "aleurone-layer" is to protect the lifeless amyliferous part of the endosperm against inimical external organisms.

On Apogamy and the Development of Sporangia upon Fern Prothalli, by William Lang, M.B., B.Sc., Lecturer on Botany, Queen Margaret College, and "G. A. Clark," Scholar, Glasgow University (*Proc. R.S.*, vol. 63, pp. 56—61).

Since the year 1874 it has been known that the prothalli of certain germs were capable of producing the fern-plant by vegetative growth, without the intervention of the sexual organs. To this phenomenon the name "apogamy" was given by De Bary. For the further study of this peculiar mode of development a series of cultures was commenced in the greenhouse attached to the Jodrell Laboratory, in November, 1895. The results, which have been described in full, in a paper communicated to the Royal Society, justify the expression of the belief that apogamy will be induced in many fern prothalli under suitable conditions of cultivation. All the eight species investigated became apogamous, and in the case of two of them (*Scolopendrium vulgare*, Sm. and *Nephrodium dilatatum* Desv.) sporangia were produced on the prothallus. The conditions to which these prothalli were subjected were long cultivation, which was rendered possible by avoiding the access of water from above and exposure to direct

sunlight. The assumption of sporophytic characters was usually preceded by changes in the form and texture of the prothallus.

The success of these cultures has led to an examination of prothalli grown in the pits of the Royal Gardens. These frequently attain a considerable size before bearing a young plant ; a number of prothalli in different pots were found to be apogamous, a single prothallus not unfrequently bearing a large number of buds. *Aspidium frondosum*, Lowe, may be specially mentioned, since in it the apogamous development of buds was clearly due to the culture not having been watered, since normal embryos were produced when this was done.

It is possible that these facts may be found to possess a practical application in the cultivation of the rarer ferns. For, as the case just mentioned showed, a single large prothallus may produce a number of buds, while it is exceptional for more than one normal embryo to be formed on a prothallus. Further, by eliminating the sexual process varieties may possibly be found to be transmitted more truly, although on this latter point the facts do not at present justify a definite conclusion.

North Wing of Temperate House.—The contract for the erection of this building, which will complete the whole structure in accordance with the original design of Decimus Burton in 1860, was entrusted by the First Commissioner of Her Majesty's Works and Public Buildings to Messrs. Mackenzie and Moncur, of Edinburgh. It is hoped that it may be completed during the present year. It is proposed to devote it to Himalayan and cool temperate New Zealand plants.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 136-137.] APRIL and MAY. [1898.

DCIII.—BOTANY OF ASHANTI EXPEDITION.

Military operations seldom afford much opportunity for scientific research. The Ashanti expedition, which left this country at the end of 1895, proved, however, an exception. Surgeon-Captain H. A. Cummins, who had done some useful botanical work in India, volunteered for service in the hope of being able to obtain some collections from the interior. One of the medical staff having at the last moment been found physically unfit, the late Sir William Mackinnon, the Director-General of the Army Medical Department, appointed Surgeon-Captain Cummins on the recommendation of Kew.

He succeeded, under considerable difficulties, in bringing back a collection of some 200 species, which included nine which were new, besides one new genus. The whole has been worked up by himself, at Kew, except the mosses which were determined by Professor Brotherus, of Helsingfors.

An enumeration of the collection is given below. The following notes were drawn up by Surgeon-Captain Cummins on the physical and botanical characters of the country traversed by him :—

The following information is taken from the notes which I made during the expedition. I travelled from Cape Coast Castle to the Moinsi Hills, which are 150 miles inland, and as I was stationed for three weeks at Assin Yan Kumassi, 58 miles from the coast, I was enabled during that time to collect specimens of the flora and obtain information about the country.

I.—Physical Features.

Extending from the coast line towards the interior the land is undulating as far as the river Prah (74 miles). The soil appears

to be composed chiefly of disintegrated granitic rock mixed with a large amount of vegetable matter, forming a loamy soil usually of a black colour, but sometimes reddish from an admixture of iron ore. From the Prah to the Moinsi Hills the undulations become more pronounced, the elevations alternating with tracts of low swampy ground until a height of 1,500 feet above the sea level is attained in the Moinsi Hills. From the coast to the river Prah rocks seldom appear above the surface of the ground, but beyond that river they are frequent, and the beds of streams are rocky with many boulders and much gravel and sand.

The small river at Brafa Edru, which is situated at the foot of the Moinsi Hills, is said to contain alluvial gold, and the quartz in the neighbourhood appears to be auriferous.

There is nothing very remarkable in the vegetation of the Moinsi Hills: it resembles that of the surrounding country. The hills have a local elevation of about 300 feet and probably consist of granite. The drainage of the general surface of the land is impeded by the undulating nature of the ground which obstructs the outflow, in some localities forming swamps into which sluggish streams discharge themselves.

The river Prah at Prahsu is about 80 yards wide and has clear water and a rocky bed. In the dry season it is shallow and the current slow, but in the rainy time of year the water is said to rise 30 feet and to flow very swiftly.

II.—Climate.

There are two well marked seasons, the 'wet' and the 'dry.' The former begins in April and lasts until November, with an intermission in August and September; the latter extends from December to March, during which period there are occasional tornados. In the forest region the climate is excessively damp during the whole year. The phenomena now to be described account for this humidity during the dry season:—

An immense amount of watery vapour is exhaled from the leaves of the large forest trees during the bright sunshine, and soon after sunset this becomes condensed, owing to the fall of temperature, into a thick mist which extends over the whole forest region, and where 'clearings' have been made reaches to the ground and becomes dispersed only when the sun is again high in the heavens.

In addition to this, free drainage of the soil is hindered by the configuration of the country, and, consequently, the level of permanent saturation is very near the surface. Evaporation may be neglected as a factor in assisting in drying the land, as the thick vegetation impedes the circulation of air and is impenetrable to the sun's rays. Consequently all the atmosphere below the summits of the high trees remains at saturation point and is very slowly replaced by fresh air. The perpetual gloom and humidity in the forest favour the fermentation of dead vegetable matter which is so plentiful, and products of decomposition are rendered evident by the unpleasant smell which pervades the air.

Judging by the nature of the diseases from which persons foreign to the country suffer while residing there, it is evident

that the soil forms a suitable nidus for the development of the malarial parasite: natives suffer, but to a less extent.

The rainy season is the most unhealthy time of year.

III.—Vegetation.

Two very distinct regions exist which merge into each other.

1. The so called 'bush.'
2. The forest region.

The 'bush' forms a belt along the coast for many miles varying in width from 3 to 25 miles. It consists of a dense undergrowth of erect, scandent and twining shrubs with comparatively few grasses, sedges and other herbaceous plants, the whole being matted together into an impenetrable thicket. Small trees occur at intervals, and a few miles from the coast huge cotton trees (*Bombax buonopozense*) appear. At Akeoful, 15 miles inland, forest trees become fairly numerous, increasing up to Mansu, 42 miles inland, where the dense forest region commences. Clumps of bamboos grow to a great size and in large numbers wherever the ground is swampy. Villages are very numerous as far as Mansu, and each possesses a tract of cultivated land. The natives plant umbrageous trees, commonly figs, in and around every village for the benefit of the shade afforded by them. By the road-side hedges of *Jatropha Curcas*, which possesses a copious white milky juice, are frequent. *Strophanthus gratus* and *S. sarmentosus* are common climbers with handsome flowers, as are also *Ipomœa palmata* and *I. involucrata*, the former having conspicuous purple flowers. *Passiflora fœtida*, *Cassia alata*, *Amarantus spinosus* and the prickly climber, *Acacia pennata*, also occur. *Myrianthus arborescens*, a tree which possesses very large leaves, each of the six leaflets being over a foot long, is of not infrequent occurrence near Dunquah. Sedges and grasses are to be seen in small numbers. Many plants which are in abundance in the forest first make their appearance at Dunquah. The ponds from which drinking water is procured are frequently covered by *Pistia Stratiotes*; this plant is said to have a purifying effect on the water.

The forest region commences about Mansu and is said to extend to the Kong mountains. The trees are of great height (100–200 feet). Amongst them the cotton trees (*Bombax*) are remarkable and very numerous; each has its smooth clean trunk free from epiphytes and climbers, which here find no foothold, and radiating from the base large buttress-roots. Far above the tops of the other trees the branches begin to come off and carry in the full sunshine the spreading foliage. The buttress-roots deserve further description; there are generally five or six to each tree, and the part above ground varies in length from 3 to 12 feet: in thickness they vary from ¼ to 4 inches at the borders, and when cut to the required size are used by the natives as doors for houses.

Other trees of the forest belong to the following genera:—*Cola*, *Sterculia*, *Carapa*, *Eriodendron*, *Monodora*, *Acacia*, *Albizzia*, *Pentaclethra*, *Lonchocarpus*, *Kickxia*, *Ficus*, *Musanga*, *Macaranga* and *Diospyros*.

The leaves of the trees form an almost uninterrupted layer of foliage which intercepts the sun's rays and causes a perpetual

gloom beneath. The majority of the high trees are deciduous, forming a marked contrast to the shrubs composing the undergrowth, which are all evergreen.

The undergrowth consists of various kinds of shrubs and scitamineous plants, aröids, and melastomaceous climbers. Vines and prickly scandent palms, forming lianes, in thickness from a thread to several inches, wind round each other in their struggle upwards towards the sun.

To the north of the Prah the trees are more closely set, branching as a rule within 20 feet of the ground, and are covered by creepers which do not seem to impair their vitality. Epiphytic shrubs, ferns, and orchids are to be seen near the tops of the highest trees. Dracænas and palms are comparatively common in the undergrowth.

When travelling through the forest many interesting and beautiful plants are seen. *Crinum sanderianum* is one—a very handsome species, the flowers of which are white and fully four inches long. *Hæmanthus multiflorus* has a head of bright red flowers, and is very frequent. The small flower heads of *Thonningia sanguinea* appear above the ground like small red stars. *Vanilla crenulata*, with purple and white flowers, hangs its long stems from the trees. *Monodora tenuifolia* has very peculiar flowers, coloured white and yellow, flecked with purple, resembling a large spider; these flowers, although three inches in diameter and very numerous, are seen with difficulty owing to their resemblance to the surrounding foliage. In many places the ground may be covered with the fallen flowers of *Eriodendron anfractuosum*, which is a very lofty tree. A species of *Rhaphidophora* (described in the *Kew Bulletin*, 1897, p. 286) is a common climber, and it seems strange that it should not have been earlier noticed. *Cephaëlis peduncularis* is a very common undershrub. Amongst other plants forming the undergrowth may be mentioned species of *Oxyanthus*, *Mussænda*, also *Paullinia pinnata*, *Leea sambucina*, *Ancistrophyllum opacum*, *Calamus deerratus*, *Dracæna arborea*, *Gouania longipetala*, *Selaginella scandens*, *Cardiospermum canescens*, *Heisteria sp.*, *Haronga paniculata*, *Oncoba echinata*, species of *Cyathula*, *Achyranthes* and *Aerua*, *Piper umbellatum*, *Dioscorea sp.* and many others.

Scitamineous plants are numerous. Species of *Costus* are frequent, and have large yellow or white flowers in a dense spike. Species of *Phrynium*, *Amomum*, *Canna*, *Calathea*, &c. occur.

A few grasses were found, *Panicum ovalifolium*, *Paspalum conjugatum*, *Centotheca lappacea*, &c. *Scleria Barteri* is an extensively climbing, very scabrous sedge.

Ferns and mosses are fairly frequent. Among the ferns are *Nephrolepis acuta*, *Pteris spinulifera*, &c.

The orchids were few and had inconspicuous flowers. The following may be mentioned :—*Megaclinium falcatum*, *Polystachya ramulosa*, *Polystachya affinis*, *Listrostachys spp.*, &c. Several commelinaceous plants occurred, *e.g.*, *Aneilema spp.*, *Palisota prionostachys*, a plant eight feet high, with purple flowers; *Pollia condensata* is to be found from Mansu inland. The berries of this plant are of a intense metallic blue colour.

IV.—Agriculture.

The system employed by the natives in the forest region is simple. The trees are cut down in the area selected for the 'clearing' and the trunks removed, if not too large and heavy, otherwise they are left to rot on the ground. All the undergrowth is then cleared away. The moist condition of the ground and foliage prevents the use of fire for this purpose. When the clearing has been satisfactorily accomplished the soil is lightly turned up and tubers, seeds, &c., are planted. The following are generally found in cultivation :—plantains, Indian corn, pine apples, sugar cane, yams, beans, ochros (*Abelmoschus esculentus*), papaws, cassava, chillies, castor oil, egg apples, cotton, cocoa-nuts, oil palms.

A distinction has been made locally between plantains and bananas ; the former never become soft when ripe and require cooking, while the latter can be eaten raw.

Very little trouble is taken to keep the land clear of weeds, consequently numbers of small herbaceous plants spring up and cover the surface of the ground.

Growth is extremely rapid in the rich soil. Ginger plants grew 18 inches in three weeks in the 'clearing' at Assin Yan Kumassi.

V.—Economic Products.

Plantains are largely grown, and form the principal food of the inhabitants. Indian corn is extensively cultivated and grows freely. Sugar cane is grown in many of the villages. Pine apples are found all over the country in such a way as to lead persons who have travelled far inland to believe them indigenous. Cola, rubber and gum trees grow plentifully in the forest region, and are reported to be more numerous in the districts around Kumassi. Palms producing 'wine' and oil are to be found in most 'clearings' ; the 'wine' is obtained after the tree has been felled, by applying heat to the summit, the heat causing it to exude from wounds made near the base. Oil is obtained from the fruits. The cocoa-nut grows as far north as Assin Yan Kumassi, and the bread-fruit tree at Prahsu. The Indian mango tree (*Mangifera indica*) is cultivated, but does not appear to ripen fruit. The leaves, flowers and young branches are usually injured by ants and other insects.

The cola nuts in the region of Assin Yan Kumassi are obtained from *Cola acuminata*, R. Br. These trees are plentiful. The natives of this region obtain rubber from *Kickxia africana*. Spiral grooves are cut in the bark of the tree from which the rubber flows. This tree has a widespread reputation for yielding excellent rubber. *Tabernæmontana crassa* yields, on incision of the bark or fruit, a copious supply of milky juice which gives good rubber ; it also grows at Assin Yan Kumassi.

Gum exudes from the bark of many leguminous trees when wounded, and soon hardens on exposure to the air.

Trees producing valuable wood are in quantity: amongst them is *Carapa guyanensis*, which is probably the "Danta" of the natives; the wood is hard and dark. The so-called "Aman" has a white close-grained wood; the "Ceda," probably a species of *Albizzia*, has a red wood. A tree yielding wood called "Quanta" is also utilised. The "Odoom" (*Chlorophora excelsa*) is said to be plentiful, and its value is well known.

The cotton tree (*Bombax*) has a soft, white wood, and is employed by the native carpenters for making canoes, stools, &c.; its brittle 'cotton' is used for stuffing pillows and mattresses. The long offshoots of several palms make excellent canes, and are much used for binding when making huts. Bamboos grow as far inland as Fumsoo; the African is not so skilful in utilising this grass for his needs as the East Indian. Native carriers take all the merchandise to the Coast except timber, which is, I believe, floated down the Prah river during the rainy season. The former method is very unsatisfactory, being uncertain and expensive. A railway is urgently required for trade purposes.

VI.—Concluding Remarks.

The great prevalence of malarial fevers renders the forest region quite unfit for European residence; the intensity of these diseases is increased tenfold when the soil is turned up.

The physique of the natives is good, but they are very indolent and superstitious, and the average mental capacity is small. Domestic animals were comparatively few. Small oxen appeared to be the only kind of animal which kept in good condition on the rank herbage. The sheep, goats, pigs and dogs seen were small and stunted in growth, and usually suffered from some skin disease. Common fowls were kept in every village, but were leggy and ill-flavoured.

The portion of the main road extending from Mansu to Kumassi becomes obstructed in many places by trunks and branches of trees after a tornado. The force of the wind is most felt at the edge of a clearing or near the road, where support from the natural surroundings has been partly removed.

The unhealthiness of the country is a great hindrance to the employment of European agents, but if a railway penetrated the forest zone, establishing a rapid means of communication with the healthy mountainous interior, as has been done in India, it is most probable that a great diminution in the death rate among Europeans would be the result, and trade in the vegetable and mineral products of the country could be carried on without the present limitations.

The friendly commercial intercourse thus established with the natives of the interior of this wealthy land would have an advantageous influence on the neighbouring native States, and thus benefit the Colony.

Hy. Cummins,
Surgeon Captain A.M.S.

London, April 19th, 1896.

LIST OF PLANTS COLLECTED, WITH THEIR GEOGRAPHICAL DISTRIBUTION AND DESCRIPTIONS OF THE NEW SPECIES.

ANONACEÆ.

Uvaria Chamæ, *Beauv.*—Sierra Leone to the mouth of the Niger.

Monodora tenuifolia, *Benth.*—Sierra Leone to the Camaroons, and Ambas Bay.

Xylopia æthiopica, *A. Rich.?*—Senegambia to Angola. The several species of Xylopia known from Uganda, Niamniam land, etc., are with difficulty separable.

MENISPERMACEÆ.

Chasmanthera nervosa, *Miers.*—From Ashanti westward to Sierra Leone.

Rhopalandria, *Stapf* (gen. nov.).—Sepala 6, 2-serialia, imbricata. Petala nulla. Fl. ♂ : stamina in columnam apice nudam truncatam antheras æquantem coalita; antheræ 6, columnæ partem superiorem circumcirca obtegentes et axi ejus parallelæ, loculis distinctis longitudinaliter dehiscentibus. Fl. ♀ ignotus.—Caulis tenuis, alte scandens. Folia cordata, tenuia. Racemi axillares, minute bracteati, floribus 3–2-natis vel solitariis.

R. Cumminsii, *Stapf* (species unica). *Caulis* sulcatus, tortus, sparse setulosus, parce ramosus. *Folia* magnitudine admodum varia, interdum rudimentaria vel plane suppressa, e basi cordata, ovata, acuminata vel caudato-acuminata, majora ad 2½ poll. longa ad 1¾ poll. lata, tenuia, 7-nervia, supra parce et adpresse setulosa, secundum margines et infra in nervos pilosula, infra glauca; petiolus tenuis, ad 1½ poll. longus, inferne tortus. *Racemi* ad 2½ poll. longi, flexuosi, graciles; pedunculus ad 4 poll. longus, flexuosus, imprimis basi setosus; bracteæ lineares, setulosæ, ad ½ lin. longæ; pedicelli tenues, 1–2 lin longi. *Sepala* ovata vel elliptica, obtusa, ad 1½ lin. longa, demum reflexa, exteriora viridia, interiora rubescentia. *Columna staminalis* vix 1 lin. longa, tenuiter spongiosa; antheræ flavidæ, vix ½ lin. longæ.

Assin Yan Kumasi, *Cummins*, 230. Also collected in Fernando Po by Mann, 416.

The plant seems to be allied to *Aspidocarya*, *Parabæna* and *Anamirta* so far as the structure of the andrœcium is concerned, but in these the anthers are different in shape and arrangement, and dehisce transversely; and besides *Aspidocarya* and *Parabæna* have petals. They are all natives of the Indo-Malayan region. Dr. Cummins' specimen is wholly leafless, but there are scars visible below the base of some of the branches: in other cases they are supported by setulous bract-like rudimentary leaves; whilst in others there is no trace of either leaf or bract. In Mann's specimen there are the same stages of leaf-reduction noticeable, but there are also perfect leaves, the blades varying from ½–2½ in. in length. The anatomy of the stem and the leaf is characteristic of the Menispermaceæ.

Capparideæ.

Gynandropsis pentaphylla, *DC.*—Widely distributed within the Tropics, reaching North Africa ; probably introduced into America from Africa.

Mærua angolensis, *DC.* ?—Widely distributed in Africa, south of the Sahara.

Violarieæ.

Alsodeia subintegrifolia, *Beauv.*—Sierra Leone to the Camaroons and the island of St. Thomas.

Bixineæ.

Oncoba echinata, *Oliv.*—From Ashanti westward to Sierra Leone.

Hypericineæ.

Haronga madagascariensis, *Choisy.*—Throughout Tropical Africa and the Mascarene islands.

Malvaceæ.

Sida rhombifolia, *Linn.*—Generally distributed in the warmer parts of the world.

Abutilon Avicennæ, *Gaertn.*—Warmer parts of the world, even extending into S. Europe.

Urena lobata, *Linn.*—Tropics generally.

Hibiscus esculentus, *Linn.*—Naturalised or cultivated throughout the tropics.

Hibiscus diversifolius, *Linn.*—Tropics of the Old World.

Gossypium barbadense, *Linn.*—Widely spread by human agency over the world ; a native of America.

Bombax buonopozense, *Beauv.*—Senegambia to Angola.

Eriodendron anfractuosum, *DC.*—Tropics of Africa, South America, and eastward through India to Java and Borneo.

Sterculiaceæ.

Sterculia *sp.*

Cola acuminata, *R. Br.*—Throughout Upper Guinea to Angola, and in Tropical America.

Dombeya Buettneri, *K. Schum.*—Ashanti, Lagos, and Togoland.

Tiliaceæ.

Grewia tetragastris, *R. Br.*—Tropical Africa, near the coast on either side of the continent.

Grewia pilosa, *Lam.*—Tropical Africa and India.

Triumfetta rhomboidea, *Jacq.*—Tropics generally.

Malpighiaceæ.

Triaspis, *T. stipulatæ*, Oliv., affinis.

Triaspis *sp.*

OCHNACEÆ.

Gomphia affinis, *Hook. f.*—From Sierra Leone to Angola, and westward to Niamniam Land.

MELIACEÆ.

Melia Azedarach, *Linn.*—A native of Asia, distributed by man through all tropical parts of the world.

Trichilia rubescens, *Oliv.*—Sierra Leone to the Camaroons.

Carapa guyanensis, *Aubl.*—Senegambia to Angola, and in Central and East Tropical America.

OLACINEÆ.

Heisteria parvifolia, *Smith.*—Senegambia to the mouths of the Niger. The genus is chiefly South American.

Heisteria, *H. parvifoliæ*, Smith, affinis.

RHAMNEÆ.

Gouania longipetala, *Hemsl.*—Ashanti to Angola.

AMPELIDEÆ.

Vitis Vogelii, *Hook. f.* Sierra Leone to Angola.

Leea guineensis, *G. Don.*—Throughout Tropical Africa and the Mascarene Islands.

SAPINDACEÆ.

Paullinia pinnata, *Linn.*—Throughout Tropical Africa, and Madagascar; and also in Tropical America.

Cardiospermum canescens, *Wall.*—Tropical Africa and India.

ANACARDIACEÆ.

Mangifera indica, *Linn.*—A native of India, introduced into all the tropical parts of the world.

CONNARACEÆ.

Agelæa brevipaniculata, *Cummins.*—*A. obliquæ*, Beauv., affinis, sed foliis longioribus angustioribus et paniculis brevibus differt. *Frutex* glaber. *Rami* graciles, teretes. *Folia* trifoliolata, circa 6 poll. longa, petiolo basi dilatato; foliolum terminale ovatum, integrum, breviter acuminatum, e basi 3-nerve, venis circa 4-jugis, 2½–3 poll. longum, 1½–2 poll. latum; foliola lateralia basi obliqua. *Flores* paniculati, axillares, 2½ lin. diam., bracteis et bracteolis et pedunculis brunneo-velutinis pilosis. *Calycis* segmenta 5, ovato-acuta, extra sparse pilosa. *Petala* lutea, anguste oblonga, concava, glabra. *Stamina* 10, filamentis basi connatis. *Carpella* 5; styli subulati, stigmatibus simplicibus. *Fructus* ignotus.

Assin Yan Kumassi, *Cummins*, 30a.

Leguminosæ.

Dolichos Lablab, *Linn.*—Cultivated throughout the Tropics.

Rhynchosia debilis, *Hook. f.*—Extends eastwards to the Camaroons and the Gaboon.

Lonchocarpus *sp.* ?

Baphia nitida, *Afzel.*—From Sierra Leone to the Camaroons and Fernando Po.

Baphia polygalacea, *Baker.*—From Sierra Leone to the Camaroons and Fernando Po, and also in Madagascar.

Cassia alata, *Linn.*—A native of America, introduced freely upon the coast of Upper Guinea.

Cassia occidentalis, *Linn.*—Tropics generally.

Pentaclethra macrophylla, *Benth.*—Senegambia to Loanda, and at Mombasa.

Acacia pennata, *Willd.*—Widely dispersed in Tropical Africa, reaching Natal and India and the Malayan Islands.

Albizzia ferruginea, *Benth.*—Senegambia to the Red Sea.

Melastomaceæ.

Tristemma Schumacheri, *Guill. et Perr.*—Throughout West Tropical Africa from Senegambia to Angola, and eastward to Uganda and Jur.

Passifloraceæ.

Passiflora fœtida, *Linn.*—Introduced from America into all parts of the Tropics.

Cucurbitaceæ.

Momordica Charantia, *Linn.*—Throughout the tropics of the Old World, and introduced into America.

Momordica cissoides, *Planch.*—From Sierra Leone to Angola and Monbuttuland, and the Zanzibar coast.

Melothria triangularis, *Benth.*—From Ashanti eastwards to the upper waters of the Nile.

Melothria *sp.*

Rubiaceæ.

Oldenlandia Heynei, *Oliv.*—Very widely distributed in Africa, south of the Sahara, also in India, Ceylon, and the Malay Isles.

Mussænda tristigmatica, *Cummins*; ramis et fructibus pilosis, stylo trifido, ovario triloculari.

Frutex 12 ped. altus. *Rami* tomentosi. *Folia* integra, obovata, subito acuta, basi cuneata, tenuia, utrinque sparse pilosa, subtus costa pilosissima, petiolata, 3–5 poll. longa, $1\frac{3}{4}$–$2\frac{1}{2}$ poll. lata, venis secundariis 12–14; petiolus pilosus, 4–7 lin. longus; stipulæ triangulares, acuminatæ, utrinque pilosæ, $4\frac{1}{2}$ lin. longæ. *Cymæ* terminales; bracteolæ anguste lineares, lanceolatæ, acuminatæ. *Flores* subsessiles. *Calyx* dense pilosus, lobis 5 ovatis vel lanceolatis acutis 7–10 lin. longis 2–3 lin. latis; sepalorum majorum

laminæ amplæ, foliaceæ, petiolatæ, luteæ, utrinque pilosæ, 3¼ poll. longæ, 2 poll. latæ, petiolis 10 lin. longis. *Corollæ* tubus dilatatus, 9 lin. longus, hirsutus, intus inferne glaber, faucibus plurimis papillis pilisque instructus, segmentis ovatis mucronatis extus villosis. *Stamina* supra mediam partem tubi affixa, filamentis brevibus, antheris linearibus. *Ovarium* 3-loculare; stylus trifidus. *Fructus* trilocularis, sicco perianthio coronatus, pilosus; semina ½ lin. longa, alveolata et minute punctata.

Assin Yan Kumassi, *Cummins*, 41, 113.

Very distinct in the three celled ovary and the wide calyx segments. It is near *M. erythrophylla*, Schum. et Thonn.

Mussænda erythrophylla, *Schum. et Thonn.*—Distributed throughout Upper and Lower Guinea, and eastwards to Niamniam and Monbuttu Lands.

Mussænda frondosa, *Linn.* ?—A native of India, Malaya, and Polynesia.

Sabicea calycina, *Benth.*—From Ashanti to the Camaroons and Fernando Po.

Bertiera macrocarpa, *Benth.*—Sierra Leone to the Camaroons and Prince's Island. The genus has several members in America, none in Asia.

Bertiera breviflora, *Hiern.*—Sierra Leone to the Camaroons.

Leptactina densiflora, *Hook. f.*—Ashanti, Lagos, and Abbeokouta.

Randia malleifera, *Benth. et Hook. f.*—Sierra Leone to the Eastern Sudan.

Amaralia bignoniæflora, *Welw.* ?—Sierra Leone and Angola to Niamniam and Monbuttu Lands.

Oxyanthus speciosus, *DC.*—Senegambia to Usambara.

Oxyanthus *sp.*

Tricalysia *sp.*

Ixora laxiflora, *Smith.*—Senegambia to Fernando Po and the Shire Highlands.

Rutidea parviflora, *DC.*—Senegambia to the mouths of the Niger.

Morinda longiflora, *G. Don.*—Sierra Leone to Niamniam land.

Geophila obvallata, *Didr.*—Senegambia to Fernando Po.

Geophila hirsuta, *Benth.*—Ashanti to the Camaroons.

Cephaelis peduncularis, *Salisb.*—Senegambia to the Islands of Fernando Po and St. Thomas.

COMPOSITÆ.

Mikania scandens, *Willd.*—A species cosmopolitan in the tropics, belonging to a genus which is otherwise American.

Microglossa volubilis, *DC.*—Throughout the Tropics of the Old World.

Melanthera Brownei, *Sch. Bip.*—Throughout the greater part of Tropical Africa. The genus is common to Africa, Madagascar, and Tropical America.

EBENACEÆ.

Maba coriacea, *Cummins*; arborescens, foliis oblongis acuminatis coriaceis.

Arbor glabra, 20–40 ped. alta. *Rami* magni, patentes. *Folia* oblonga, acuminata, integra, coriacea, petiolata, 5–7 poll. longa, $1\frac{1}{2}$–$2\frac{1}{2}$ poll. lata, supra nitida. *Flores* ♂ 4-meri. in cymis abbreviatis paucifloris ad nodos ramorum annotinorum vel vetustorum dispositi; pedicelli breves, bracteati: bracteæ parvæ, ovatæ, acutæ, minute vel obsolete ciliolatæ, imbricatæ. *Calyx* subtruncatus vel 4-lobatus, 2 lin. longus, lobis rotundis extus sparse pilosis apiculatis. *Corolla* lutea vel alba, tubulosa, basi dilatata, faucibus contracta, tubo 3 lin. longo, lobis contortis patulis ovatis 2 lin. longis. *Stamina* 16, basi corollæ inserta; antheræ lineares $1\frac{1}{2}$ lin. longæ; filamenta sparse pilosa, circiter $1\frac{1}{2}$ lin. longa. *Ovarii* rudimentum parvum, late ovatum, acutum.

Assin Yan Kumassi, *Cummins*, 119, 242. A rather common tree.

Diospyros *sp.*—Superficially resembling *D. verrucosa*, Hiern, but the seeds are not ruminate.

APOCYNACEÆ.

Rauwolfia *sp.*

Tabernæmontana, *T. Barteri*, Hook., affinis.

Tabernæmontana subsessilis, *Benth.* ?—Confined to Upper Guinea.

Tabernæmontana crassa, *Benth.* ?—Hitherto only from the Gold Coast.

Strophanthus gratus, *Franch.*—Confined to Upper Guinea.

Strophanthus sarmentosus, *DC.*—Senegambia to the Camaroons.

Kickxia africana, *Benth.*—Sierra Leone to the Gaboon.

ASCLEPIADEÆ.

Secamone *sp.*

LOGANIACEÆ.

Gærtnera paniculata, *Benth.*—Sierra Leone to the Gaboon.

BORAGINEÆ.

Heliotropium indicum, *Linn.*—Excepting Australia and Polynesia, world wide in the Tropics.

CONVOLVULACEÆ.

Ipomœa obscura, *Ker-Gawl.*—Throughout the Tropics of the old world.

Ipomœa involucrata, *Beauv.*—Throughout Tropical Africa.

Ipomœa palmata, *Forsk.*—Throughout the warmer parts of Africa, and in the Mascarene Islands, and Tropical Asia.

Lepistemon africanum, *Oliv.*—Tropical Africa.

Hewittia bicolor, *Wight et Arn.*—Tropics of the old world.

Breweria secunda, *Benth.*—Senegambia to the Camaroons.

Solanaceae.

Solanum Welwitschii, *C. H. Wright*, var. **strictum**, *C. H. Wright.* —This species has been found in Ashanti, Angola, and about the head waters of the Nile.

Capsicum frutescens, *Linn.*—Cultivated or naturalised throughout the Tropics. Native country uncertain.

Datura Stramonium, *Linn.*—Very nearly world wide in the Temperate and Tropical Zones.

Scrophularineæ.

Artanema sesamoides, *Benth.*—India, Malaya, and on both sides of Tropical Africa.

Acanthaceæ.

Brillantaisia salviiflora, *Lindau.*—Ashanti and Togoland.

Paulo-wilhelmia polysperma, *Benth.*—Sierra Leone to the Camaroons.

Phaylopsis microphylla, *T. Anders.*—Ashanti to the Gaboon.

Phaylopsis *sp.*

Lankesteria elegans, *T. Anders.*—Ashanti to the Gaboon.

Barleria opaca, *Nees.*—Ashanti and Lagos.

Asystasia vogeliana, *Benth.*—Ashanti to the Camaroons and Fernando Po.

Eranthemum ludovicianum, *Buettn.*—From Ashanti and Fernando Po to the Congo.

Justicia *sp.*

Hypoestes verticillaris, *R. Br.*—Throughout Africa, south of the Sahara.

Verbenaceæ.

Vitex micrantha, *Gürke.*—Sierra Leone to Ashanti. The berries of this species are ¼ inch long.

Clerodendron volubile, *Beauv.*—Sierra Leone to the Congo.

Labiatæ.

Hoslundia opposita, *Vahl.*—Throughout Tropical Africa.

Solenostemon ocymoides, *Schum. et Thonn.*—Senegambia to Angola and Niamniam Land.

Nyctagineæ.

Mirabilis Jalapa, *Linn.*—An American weed introduced into many parts of the Tropics.

Amarantaceæ.

Amarantus spinosus, *Linn.*—Widely distributed in the Tropics; in Africa only near the coast.

Cyathula prostrata, *Bl.*—Tropics throughout the world.

Pupalia lappacea, *Moq.*—Tropics of the old world.

Ærua lanata, *Juss.*, var. **viridis**, *Moq.*—Tropics of the old world, eastward to Java and the Philippines.

Achyranthes aspera, *Linn.*—Everywhere in the Tropics.

PHYTOLACCACEÆ.

Mohlana nemoralis, *Mart.*—Widely distributed in Africa and Madagascar; also in South America, and naturalised in Ceylon.

PIPERACEÆ.

Piper subpeltatum, *Willd.*—Throughout the Tropics of the old world.

THYMELÆACEÆ.

Dicranolepis Persei, *Cummins*; fruticosa, foliis subglabris ellipticis apice acuminatis basi cuneatis, perianthii tubo subfiliformi sericeo, limbi segmentis late ellipticis.

Frutex 4–8 ped. altus. *Rami* sparse pilosi. *Foliorum laminæ* ellipticæ, integræ, acuminatæ, 3½ poll. longæ, 1½ poll. latæ, basi cuneatæ, nerviis primariis multis, subtus sparse pilis appressis vestitæ; petiolus 1½ lin. longus. *Flores* in axillis geminati, breviter pedicellati, sericei, bracteis et bracteolis lanceolatis parvis pilosis. *Perianthii* lobi patentes, late elliptici, concavi, 5 lin. longi; tubus subfiliformis, 10 lin.–1 poll. longus; squamæ angustæ, 9 lin. longæ. *Staminum* filamenta 1¼ lin. longa; antheræ æquilongæ. *Ovarium* oblongum, in disco immersum; stylus gracilis, stigmate ovato dilatato. *Fructus* ignotus.

Assin Yan Kumassi, frequent, *Cummins*, 186.

Allied to *D. grandiflora*, Engl., and *D. vestita*, Engl. It differs from the former in having larger leaves, a shorter and thicker perianth-tube, and shorter filaments, and from the latter in its thinner and less hairy perianth-tube and more globular flower buds.

BALANOPHOREÆ.

Thonningia sanguinea, *Vahl.*—Ashanti to the Niger.

EUPHORBIACEÆ.

Phyllanthus Niruri, *Linn.*—Tropics, except Australia.

Uapaca guineensis, *Muell.-Arg.*—From Ashanti to Fernando Po.

Microdermis puberula, *Hook. f.*—Sierra Leone to Angola.

Jatropha Curcas, *Linn.*—Throughout the Tropics; widely cultivated.

Croton lobatus, *Linn.*—Throughout Tropical Africa to Arabia Felix; very widely spread in Tropical America.

Acalypha paniculata, *Miq.*—Tropical Africa and eastwards to Java.

Alchornea cordata, *Benth.* non *Muell.-Arg.* (*A cordifolia*. Muell.-Arg.).—Sierra Leone to Niamniam Land and Uganda.

Macaranga Schweinfurthii, *Pax.*—Ashanti and the Eastern Sudan. The fruits, which have not been previously described, are produced abundantly about Assin Yan Kumassi, both on young and old branches, and may be thus described.

Capsula rubra, in coccos circa ½ poll. diam. sulcatos dissiliens. *Semina* circa ¼ poll. diam., nigra.

Tragia cordifolia, *Benth.*—Ashanti to Angola, and in Madagascar.

Dalechampia ipomœæfolia, *Benth.*—Ashanti to the Camaroons.

URTICACEÆ.

Ficus eriobotryoides, *Kunth et Bouché.*—Ashanti to Angola and Monbuttu Land.

Ficus, *F. Baroni*, Baker, affinis.

Ficus *sp.*

Myrianthus arboreus, *Beauv.*—In most parts of Tropical Africa.

Musanga Smithii, *R. Br.*—Sierra Leone to Angola, Monbuttu Land and Uganda.

Fleurya podocarpa, *Wedd.*—Ashanti to the Camaroons, and Uganda.

ORCHIDEÆ.

Megaclinium falcatum, *Lindl.*—Sierra Leone to Angola.

Eulophia saundersiana, *Reichb. f.*—Lagos and Ashanti to the Camaroons.

Polystachya ramulosa, *Lindl.*—Sierra Leone and Ashanti.

Polystachya affinis, *Lindl.*—Sierra Leone to the Lower Niger.

Listrostachys *spp.*—Two species were collected, both without flowers.

Vanilla crenulata, *Rolfe.*—Sierra Leone and Ashanti.

SCITAMINEÆ.

Amomum *spp.*—Fragments of two species.

Costus afer, *Ker-Gawl.*—Sierra Leone to Usambara.

Renealmia battenbergiana, *Cummins* ex *Baker*, in Flora Trop. Africa, Vol. vii., 313.—As far as at present known, confined to Ashanti.

Donax cuspidata, *K. Schum.*—Sierra Leone to the Lower Congo, and to Niamniam Land.

Trachyphrynium *sp.*

Thaumatococcus Danielii, *Benth.*—Sierra Leone to the Camaroons and the Island of St. Thomas.

Phrynium Benthami, *Baker.*—Ashanti to the Camaroons.

Phrynium brachystachyum, *Kœrn.*—Sierra Leone to the Niger and Corisco Bay.

Calathea conferta, *Benth.*—Ashanti to Angola. The genus is chiefly South American.

Canna indica, *Linn.*—Tropics of Asia and America; naturalised in many parts of Tropical Africa.

AMARYLLIDEÆ.

Crinum sanderianum, *Baker*.—Sierra Leone to Lagos.

Hæmanthus multiflorus, *Martyn*.—Widely distributed in Tropical Africa.

DIOSCOREACEÆ.

Dioscorea abyssinica, *Hochst.* ?—An imperfect specimen, very similar to the species known from Abyssinia and Jur.

Dioscorea minutiflora, *Engl*.—Ashanti to the Camaroons.

LILIACEÆ

Asparagus racemosus, *Willd*.—Tropics of the Old World.

Dracæna arborea, *Link*.—Ashanti to Angola.

Dracæna surculosa, *Lindl*.—Sierra Leone to the Camaroons.

COMMELINACEÆ.

Pollia condensata, *C. B. Clarke*.—Sierra Leone to Angola and Uganda.

Palisota prionostachys, *C. B. Clarke*.—Ashanti and the Gold Coast to Monbuttu Land.

Polyspatha paniculata, *Benth*.—Sierra Leone to the Camaroons.

Aneilema æquinoctiale, *Kunth*.—Throughout Tropical Africa.

Aneilema beninense, *Kunth*.—From Sierra Leone and Angola to Ruwenzori and Niamniam Land.

PALMÆ.

Calamus deerratus, *Mann et Wendl*.—Sierra Leone to the Camaroons.

Ancistrophyllum opacum, *Drude*.—Ashanti to Fernando Po and the Camaroons.

AROIDEÆ.

Pistia Stratiotes, *Linn*.—Everywhere throughout the Tropics.

Anchomanes Hookeri, *Schott*.—Throughout Tropical Africa.

Cercestis Afzelii, *Schott*.—Ashanti to Sierra Leone.

Rhaphidophora africana, *N. E. Br*.—Sierra Leone to Fernando Po.

CYPERACEÆ.

Mariscus umbellatus, *Vahl*.—Tropical Africa, Mascarene Islands; introduced into India.

Kyllinga pumila, *Mich*.—Tropical Africa and the warmer parts of America.

Scleria Barteri, *Bœck*.—From Ashanti to the Gaboon.

Gramineæ.

Paspalum conjugatum, *Berg.*—Tropics of both worlds, perhaps of American origin. In Africa from Sierra Leone to Monbuttu Land.

Panicum plicatum, *Lam.*—Tropics throughout the world.

Panicum ovalifolium, *Poir.*—Upper Guinea generally; also in Madagascar.

Panicum, *P. ovalifolio*, Poir., affine.

Oplismenus compositus, *Beauv.*—Warmer countries throughout the world.

Pennisetum Benthami, *Steud.*—Throughout tropical Africa.

Olyra latifolia, *Linn.*—Tropics of Africa and of America.

Centotheca lappacea, *Desv.*—Warmer parts of the Old World, extending eastwards into Polynesia.

Streptogyne crinita, *Beauv.*—Tropics of America, India, but in Africa restricted to Upper Guinea.

Selaginellaceæ.

Selaginella scandens, *Spring.*—Senegambia to Angola.

Filices.

Davallia Speluncæ, *Baker.*—Throughout the tropics of the Old World.

Adiantum tetraphyllum, *Willd.*—Upper Guinea and Angola to Lake Tanganyika; also in the Mascarene Islands and in tropical America.

Lonchitis pubescens, *Willd.*—Throughout tropical Africa, in the Mascarene Islands and South America.

Pteris quadriaurita, *Retz.*—World-wide in the tropics.

Pteris spinulifera, *Schum.*—Throughout Tropical Africa.

Asplenium sinuatum, *Beauv.*—From Ashanti to Usambara.

Asplenium macrophlebium, *Baker.*—Ashanti to the Camaroons.

Nephrodium subquinquefidum, *Hook.*—Senegambia to Angola and Tropical America.

Nephrodium molle, *Desv.*—Tropics generally.

Nephrodium pennigerum, *Hook.*—Throughout Tropical Africa, to the Mascarene Islands, India and Malaya.

Nephrodium truncatum, *Presl.*—Throughout the tropics of the Old World.

Nephrolepis ramosa, *Moore.*—Throughout the tropics of the Old World.

Nephrolepis acuta, *Presl.*—Tropics generally.

Polypodium cameroonianum, *Hook.*—Ashanti to Loango.

Polypodium Phymatodes, *Linn.*—Tropics of the Old World.

Vittaria lineata, *Sw.*—In most parts of the tropics.

Acrostichum punctulatum, *Sw.*—Tropical Africa and the Mascarene Islands.

Acrostichum sorbifolium, *Linn.*—Tropics throughout the world.

Platycerium Stemmaria, *Beauv.*—Sierra Leone and Angola to Niamniam Land.

LEUCOBRYACEÆ.

Leucophanes horridulum, *Brotherus; L. Cameruniæ*, C. Müll., affine, sed rigiditate, foliis horride patentibus glaucescenti-viridibus oculo nudo jam dignoscendum.

Planta dioica, cæspitosa, cæspitibus rigidiusculis densis pallide glaucescenti-viridibus nitidiusculis. *Caulis* ad 8 lin. usque altus, dense foliosus, infima basi radiculosus, simplex. *Folia* sicca et humida patentia, horrida, fragilia, canaliculata, e basi oblongo-elliptica, subvaginantes, lineari-lanceolata, apice rotundatula, interdum radiculis prædita, marginibus summo apice minute denticulatis, limbata, limbo tenui hyalino usque ad apicem producto, nervo tenui excurrente; cellulæ rectangulares, basilares laxæ hyalinæ, superiores angustiores chlorophyllosæ. Cætera ignota.

Ashanti, *Cummins.*

FISSIDENTACEÆ.

Fissidens sarcophyllus, *C. Müll.*—Ashanti to the Camaroons.

NECKERACEÆ.

Papillaria Cameruniæ, *C. Müll.*—Ashanti to the Camaroons.

Pilotrichella communis, *C. Müll.*—Ashanti to the Camaroons.

Neckera spuriotruncata, *C. Müll.*—Ashanti to the Camaroons.

HOOKERIACEÆ.

Hookeria africana, *Paris.*—Ashanti to the Niger and Fernando Po.

LESKEACEÆ.

Thuidium involvens, *Mitt.*, var. **thomeanum,** *Broth.*—This species is common to West Tropical Africa and Tropical America; the variety has now been found in Ashanti and on the island of St. Thomas.

Thuidium gratum, *Jaeg.*—Tropical America and West Tropical Africa.

HYPNACEÆ.

Trichosteleum borbonicum, *Jaeg.*—Tropics of the Old World.

Microthamnium subelegantulum, *Broth.*—Ashanti and the island of St. Thomas.

Isopterygium aptychose, *Broth.* (*Hypnum aptychose*, C. Müll). —Ashanti, Niger and Old Calabar.

Ectropothecium anisophyllum, *Broth.*—Ashanti to the Camaroons.

Leucomium perglaucum, *Broth.*—Ashanti to the Camaroons.

LEJEUNEEÆ.

Phragmicoma florea, *Mitt.*—Ashanti, Niger and Camaroons.

DCIV.—ZOMBA BOTANIC STATION.

An interesting account of the steps taken to establish a Botanic Station at Zomba, in the British Central African Protectorate, was given in the *Kew Bulletin*, 1895, pp. 186-191. This was based on a Report presented to Sir H. H. Johnston by Mr. Alexander Whyte, the head of the Scientific Department, who had virtually started the first Botanic Garden in Central Africa. Since Mr. Whyte's retirement Mr. McClounie has been in charge of the Zomba Garden, while Mr. John Mahon, formerly at Kew, is in charge of the forestry branch. The following progress report for 1897, prepared by Mr. McClounie, was published in the *British Central Africa Gazette*, dated the 5th February, 1898 :—

"During the past year steps were taken to bring under cultivation, by deep-trenching, much more of the grounds than was formerly tilled. The soil over most of the garden is of such a hard description that to expect a crop of anything in the way of soft, fibrous, or tuberous roots without first bringing it to a friable condition is almost vain.

"The entire absence of humus on the slopes of Zomba is very marked, it having been washed down during many years into the numerous swamps found in the vicinity.

"Solar radiation in these parts is exceedingly great, especially during October and November, and this action on the soil is such as to make it so extremely hard that it prevents the admission of light, air, and water.

"The method adopted in trenching was such as is generally practised in all Horticultural Gardens, and, though new to the natives employed, with a little supervision it is remarkable how quickly they can trench a patch of ground.

"Large quantities of refuse, such as weeds, banana leaves, and manure, can be covered in while trenching, but the newly turned-up soil must be exposed for some time to the action of the air and water before its dormant constituents become active plant food.

"Surface feeding, fibrous-rooted plants, such as strawberries, will succeed well twelve months after trenching, and it has come under my observation that potatos do not thrive on newly trenched plots until after a period of two or even three years has elapsed, when the soil becomes fertile to the full depth.

"Coffee in British Central Africa has eminently exemplified this theory, but of this I hope to write in another issue."

Flowers.

"The specimens of flowering plants in the gardens are worthy of mention, many came from Kew or Durban, and have been successfully grown.

"The following plants flowered exceedingly well :—

Allamanda neriifolia,
Beaumontia grandiflora,
Bougainvillea spectabilis,
,, glabra,
Aristolochia ornithocephala,

Clerodendron Thomsonæ,
Hibiscus—several,
Amaryllis—mixed,
Pancratiums,
Liliums,
Clematis indivisa,
Zephyranthes lindleyana,
Haemanthus—local spp.
Crinums—local spp.
Albizzia—local spp.
Poinsettia pulcherrima.

"The Allamanda does exceedingly well, continuing to flower for a long time and producing seed. *A. violacea* is not of robust growth but succeeds fairly well.

"The massive, well developed, rich white flowers of the *Beaumontia* are a striking object of beauty in a vase within doors or in the garden. Propagation of it, however, is very difficult, and few cuttings of it have rooted. The blaze of the Bougainvilleas imparts a colour and effect which make them very desirable plants for a verandah.

"The strong growth of the *Aristolochia*, and the singular form of the flowers, which are produced freely, are worthy of notice and a place in any garden. The *Clerodendron* and *Hibiscus* also succeed well, as also do the beautiful *Poinsettia* and *Albizzia*.

"The perfect mass of flower on *Clematis indivisa* is often met with on the slopes of Zomba.

Fruits.

"Strawberries (common Alpine) have been successfully cultivated, and, considering the excellence of these fruits, it is safe to predict that the home varieties now introduced will do exceedingly well.

"Bananas, papaw, and pineapples luxuriate in the gardens. Several trees of the Avocado pear are promising, and the Litchi fruit tree is of good growth.

"The large Grenadilla (*Passiflora quadrangularis*) succeeds well against a wall and bore several fruits last year."

Coniferae, Ornamental and Economic Plants and Shrubs.

"The avenues of cypresses, thuyas, &c., are striking features of the grounds, and, as these stand the ravages of locusts, they are at all times objects of beauty.

"Several specimens of the wild date palm gracefully mingle with the compact *Coniferae*.

"A young plantation of Mlanje cedars, planted about three years ago, is in a thriving condition. A large quantity of cedar seed has been sown and has germinated well.

"These will be ready for planting during next season's rains in and around all the Residency grounds, while there will be a large quantity available for distribution and for transplanting on the top of Mount Zomba, where it is fully expected they will thrive as well as on Mlanje.

"*Grevillea robusta* and Albizzias—the trees about which so much has been said as shade trees for coffee—are of sufficient size for anyone to judge of their capabilities as shade trees, as also of *Erythrina umbrosa*.

"A small quantity of seed has been taken off the Grevilleas this past season, and all have germinated.

"Large quantities of Mlanje cedar seed have been sent to the Agricultural Department, Cape Town, the Botanic Gardens, Durban, and to Basutoland, as well as to different parts of the Protectorate.

"There are a few other ornamental plants such as agaves, aloes, *Cycas revoluta*, *Pandanus Veitchii*, Cannas of sorts, and some Elephant Caladiums."

COFFEE.

"Following these remarks on the Garden, something on soil and cultivation with regard to coffee may not be out of place.

"Many have been the arguments in favour of shade for coffee as being the one thing required to make it a success. It is not consistent with reason that any shrub such as coffee can derive any benefit from another tree growing in close proximity, requiring as much and more nourishment as the plant from which is expected a marketable produce.

"The predominant elements required for the cultivation of coffee, are, under the present methods of treatment, only partially provided. Hence a good return is often had in the third year from planting, and from that onward the shrubs have a precarious existence. The reason is not far to seek.

"The pitting operation is in itself a saving of labour and also of time, but, were all the ground thoroughly trenched to the depth of two feet between the plants the first year, and all refuse buried, not burned, this would admit light, air, and water, and so fertilize the whole, through which the roots will spread in search of nourishment, with no hard walls—as in the case of pitted ground only—to hinder their progress. Considering the tremendous heat of the sun on the permeable nature of the soil trenched as above, burning or extreme drought might result therefrom, but it ought to be part of the routine of work to see that a sufficient amount of grass, weeds, &c., is buried a little under the surface as a means of shade for the roots, and also adding, by slow decomposition, carbonic acid.

"I have stated that burning might result from the ground being too permeable, but at certain times it is impossible to escape atmospheric effects, and when coffee has been burned and all the leaves off, thinning ought to be resorted to, as much as pruning is a recognized part of the labour of an estate. If several years crops are desired (instead of one and clear out) thinning ought to be looked to when the berry is about the size of a pea, and discriminately proceeded with so that the sap that is in the tree may be concentrated upon the few rather than partially upon the many, producing what is known as 'lightberry.' Unthinned the berries swell, and the nourishment gets exhausted before maturity."

(Signed) JOHN MCCLOUNIE.

DCV.—BOTANICAL MUSEUMS IN BELGIUM AND HOLLAND.

With the sanction of the First Commissioner, Mr. J. M. Hillier, Assistant in the Museums of the Royal Gardens, was directed to visit the principal botanical museums in Belgium and Holland in October last. The object in view was to identify unnamed products and specimens in the Kew Museums, to effect exchanges and to obtain information as to improved methods for preserving objects in fluid.

Mr. Hillier on his return furnished the following report :—

I visited, between the 2nd and 19th of October, the principal museums of Belgium and Holland containing collections of vegetable economic products.

I have observed much that was interesting, and have obtained information that will enable us to identify the Botanical origin of various unknown specimens in the museums of the Royal Gardens together with notes of many products, particularly of the Dutch East Indies, in which our collections are deficient. The Colonial Museum at Haarlem has afforded the greatest amount of valuable information in this respect.

The arrangement of the various museums visited and the mounting of specimens generally offered some suggestions that will be useful in our museums.

I have been fortunate in securing details of an excellent preservative solution, not yet experimented with at Kew, but which I feel sure will be valuable, and also details of a system for drying Botanical objects with sand and heat, together with a new and improved method for sealing glass disks to jars.

I experienced the greatest courtesy and kindness from the authorities of each institution I visited, and had every facility afforded me for studying the various collections.

Maison de Melle, near Ghent.

The Maison de Melle is an educational establishment situated about six miles from Ghent in the centre of an agricultural district.

The building stands in its own grounds about ten minutes' walk from the station and has a bad approach. The Prefect of Studies, Mr. Ernest, received me with every kindness.

The museum is a large and varied one, arranged in wall and table cases, scattered about in various portions of the building, the specimens being classified according to their uses. Very few specimens are in fluid. I noticed many vegetable products presented to the institution by Kew some years since, and was particularly interested in a fine series of printed muslins, and cotton fabrics, together with a printing block used in their production, the more delicate portions of the design being formed of metal pins inserted into the block. I also observed some curious brass vessels similar in shape to an egg cup, and a small jug with a straight handle, used in Turkey in the preparation of coffee.

Notes were taken of other products of more or less interest forming desiderata for the Kew collections.

The number of students varies from 250 to 300.

The laboratory I was given to understand is an exact facsimile of that at the University of Bonn on the Rhine. The institution has its own gas-works, theatre, gymnasium, and swimming-baths and in every way appears to be a splendidly arranged establishment.

University Botanic Garden, Ghent.

These gardens are not very extensive, but contain six glass houses with a large percentage of economic plants. Mr. G. Staes, Preparator at the University, very kindly showed me the small Museum collection which is exclusively used for teaching purposes for the students of medicine and chemistry. I saw no products in the collection worthy of special mention, but was much interested in the preservative solution used, which consists of alcohol with the addition of 2 per cent. of hydrochloric acid. The object to be preserved is placed in this solution for a few weeks according to discretion, after which it is put into methylated spirit for permanent preservation. Though this is a bleaching solution, some specimens submitted for my examination which had been so treated were excellent, especially some examples of fungi and some leaves with galls. In the latter case the leaves were bleached while the galls remained of a brownish colour and could readily be distinguished.

Many of the more delicate objects in this fluid were mounted on blue opaque glass, and were very effective.

Commercial Museum, Brussels.

This institution appears to be a very important one. The collections are extensive and very varied in character, and consist chiefly of articles of commerce collected by Belgian Foreign Consuls. They are arranged in tall cases, oblong in shape, containing three to four glass shelves on brass supports with no division down the centre. Around the base of the cases is a narrow platform or step, about one foot high, to facilitate the examination of the specimens on the upper shelves. Part of the collection is arranged in table cases. As a rule scientific names are not attached to the products, but useful details are given on the labels with regard to prices, &c. I noticed many articles of British manufacture. The exhibit of tobacco is a particularly good one and contains an excellent series, collected in Constantinople, of various forms from Asia Minor, in the original packages of very neat and attractive appearance. I also noticed brass vessels from Turkey used in the preparation of coffee and identical with those I had previously seen at the Maison de Melle. The collections are neatly labelled and carefully tended, no specimens being in fluid. Attached to the collection is a Bureau of Information where full details may be obtained concerning the exhibits. At the time of my visit many persons were consulting the Museum.

Royal Botanic Gardens, Brussels.

These gardens are not very extensive, but are delightfully situated. The houses contain a large collection of Aroideæ and ferns, but few palms. Professor C. Bommer was kind enough to escort me over the establishment. At the time of my visit a large number of plants was being raised from seeds received from the Congo.

The Museum and Herbarium collections consist chiefly of specimens collected by Martius. As far as I could judge of the Museum collection, it is a good one and is very rich in South American products, but unfortunately I could see very little of the collection as it was practically stowed away until a suitable building was available to receive it. I understood from Professor Bommer that a new building would shortly be erected for the reception of the Herbarium, and that the present Herbarium building would be converted into a museum. It would be a great pity were such a valuable collection to be neglected and improperly housed, as from its dimensions and the fact of most of the specimens having been collected by Martius it must contain many rare and valuable products.

I availed myself of the opportunity of calling upon Professor Errera of the Botanic Institute of the University of Brussels who has been so successful in preserving flowers, &c., in their natural colours. Unfortunately he was away at the time, but Professor Bommer very kindly showed me Professor Errera's specimens and at the same time gave me details of the process for future experiment. The specimens I saw were excellent.

The process is a simple one. The specimen to be preserved is placed in a conical shaped paper bag, the narrow diameter resting in the mouth of a glass jar. The bag is carefully filled up with finely sifted sand, after which the jar, together with its contents, is kept at a warm even temperature for two or three weeks, at the expiration of which time the sand is carefully removed and the dried specimen placed in a stoppered jar. The stopper must be hollow and filled with unslaked lime, the latter being kept in position by a thin piece of leather tied over the portion of the stopper which is inserted into the mouth of the jar. The lime absorbs all moisture and so preserves the specimen from deterioration by damp.

International Exhibition at Brussels.

The site of the exhibition was on the eastern side of the city in the Parc du Cinquantenaire where the exhibition of 1880 was held, and covers an extensive area. Generally speaking, the exhibition was not rich in raw vegetable products, but, nevertheless, it contained many interesting exhibits.

The Museé Scolaire section included exhibits of diagrams and models of natural history objects for teaching purposes. The Botanic Institute of the University of Brussels had an interesting series of fruits and seeds illustrating various modes of dissemination, also a collection of well preserved flowers dried by the sand process previously described.

Very few of the sections contained specimens of raw vegetable products. The Paraguayan exhibits were the best in this respect. Liberia, Chili, and San Domingo were also represented, but I noticed nothing of a novel character in the courts or worthy of special mention.

The Antwerp Chamber of Commerce had a fine collection of raw and manufactured tobaccos, various bales of Turkish tobacco being especially striking and similar to those contained in the Commercial Museum of Brussels.

A very fine collection of plain and ornamental straw plaits from Chefoo, together with a series of China teas, were the only other exhibits of special interest observed in a hurried visit.

Congo Exhibition, Tervueren.

The Congo section of the Brussels Exhibition is located at Tervueren, some few miles out of Brussels, from whence it is approached either by rail or electric tram. The Congo exhibits were contained in a large building the centre portion of which was used as a restaurant, while the two side wings were occupied by the collections. On the one side was the ethnographical section which consisted of a very large and varied assortment of articles of native industry, and also a court containing a lottery exhibition consisting of various works of art in ivory and the more beautiful of the Congo woods. The collections were arranged in bays formed of the wood of *Sarcocephalus Diderrichii*, and typifying Congoese architecture, being very tastefully displayed. To add to the interest of the collection a frieze runs round the upper part of the courts, upon which is depicted scenes of native life on the Congo. Unfortunately the ethnographical objects were unlabelled at the time of my visit. The corresponding court on the other side of the building contained the products of the Congo, together with a Commercial Museum, this latter consisting of a medley of articles which find a market in the Congo region.

The collection of vegetable products was not a large one but made a good show. Chiefly to be observed are trophies of horseshoe pattern filled in with copal and rubber, many fine blocks of copal and small parcels of the latter wrapped in leaves and netted over with what appears to be the split petiole of a palm. I also noticed a series of specimens illustrating the extraction of rubber from the roots of *Landolphia* spp. by crushing, shredding, and mastication. This court also contained some splendid photographs illustrating sugar-making, decorticating rice, the collection of palm wine, tobacco fields, specimen trees, and an illustration of the mode of collecting rubber from which it seems that the vine is bent over and the milk runs from deep cuts made round the stem into pots suspended to receive it.

A conservatory at the back of the building contained many living plants of the Congo, of more or less economic interest, on loan from the Royal Botanic Garden, Brussels, and from other sources.

A typical Congo village forms part of the exhibition, but as the natives had left, little of interest remained excepting the buildings.

In another portion of the grounds a forester's hut built of pine logs contains an instructive collection exhibited by the Belgian Forest Department.

Botanic Garden, Antwerp.

This garden is a small one but contains many interesting plants which are, generally speaking, very distinctly labelled. The museum collection is contained in a large and lofty room which is well lighted by side windows. The specimens are scientifically arranged in two long cases of about 50 feet, and of similar height and depth to those in the No. 1 Museum at Kew.

Most of the bottles employed here have screw metal lids and few specimens are preserved in fluid. The collection does not appear to have been added to lately but, nevertheless, contains many good things, and afforded some valuable information bearing upon undetermined samples in the Kew Museums.

Commercial Museum, Antwerp.

The museum is similar to that at Brussels but much less extensive. The specimens are very varied in character and well looked after. I observed nothing in the collection that was new to me nor any products in which the Kew Museums are deficient. The cases are ebonized and of various shapes.

Rijks' Herbarium, Leyden.

The Herbarium is very much overcrowded, there being only sufficient case accommodation for about half the number of specimens. Mr. Goethart received me very kindly, and gave me some useful hints to assist in identifying some unknown products from the Dutch Indies in the Kew Museum. The Museum collection was packed up at the time of my visit as the floor had been destroyed by dry rot and was being re-laid. I gathered from Mr. Goethart that the specimens consist chiefly of fruits collected in the East by De Vriese, Korthals, &c., and, as far as I could judge under the circumstances, have been carefully labelled and are in good condition. Very few of the specimens I saw bore native names. The available wall space in the Herbarium is utilised for the exhibition of coloured drawings and dried specimens of useful plants. The only preservative solution used is methylated spirit.

Botanic Garden, Leyden.

These gardens are attached to the University. The houses contain a varied collection of plants, many being of economic interest, but rather crowded together.

The Museum collection is badly housed and very crowded, which is regrettable, as if properly arranged and spread out it would form a valuable museum.

I was enabled to obtain valuable notes from this collection bearing upon unknown products and upon several deficiencies in the Kew collections.

Were this collection and that of the Rijks' Herbarium merged and placed in a suitable building they would form an important institution.

Colonial Museum, Haarlem.

The building is an imposing structure delightfully situated on the outskirts of the town in the immediate neighbourhood of the Frederiks' Park. It is the property of the State, which keeps the fabric in repair, and for the past ten years has granted an annual subsidy towards the up-keep of the collections which are the property of the important Dutch Society of Industry. This society founded the Museum about 26 years ago, and, together with the provinces, the city of Haarlem, and large commercial firms, supply the necessary funds for the proper working of the Institution. The gross annual income from all sources amounts to about 10,000 gulders.

The Director of the Museum, Dr. F. W. van Eeden, and his assistant, Dr. M. Greshoff, were most kind to me, and at all times readily gave me any desired information concerning the collections, which are very large and complete. The specimens are arranged according to their uses, and are much crowded, every available space being utilised; the walls for the most part are covered with well-mounted dried specimens and figures of useful plants, together with many photographs illustrative of the various industries connected with the products.

Spirit is the only preservative solution used. Specimens of fruits, seeds, &c., which are not absolutely dry are placed in stoppered jars, the stoppers being filled with unslaked lime to absorb the moisture so that the specimens may be placed at once in their respective positions.

As the time at my disposal was limited, I found it impossible to thoroughly go through the collections, which would take at least a fortnight, so I devoted the time almost exclusively to the products of the Dutch East Indies, in which the Museum is very rich. Here I made notes of very many products wanting in the Kew Museums and arranged with Dr. van Eeden for an exchange of duplicates.

Schools are largely supplied with duplicates.

The upper floor of the building contains the Art Industrial collection belonging to the same society, but distinct from the Museum, and in the immediate vicinity is a school of design.

University Botanic Garden, Amsterdam.

These gardens are situated in the Jewish quarter of the city to the south of the Entrepôt Dock, and are generally known as the "Hortus." They are open daily from 6 until 6 in the summer, and from 7 until 5 in the winter, the same arrangement applying to Sundays. There are seven glass-houses in all. The *Victoria regia* house has a gas pendant immediately above the tank, with a large and somewhat hideous ball-shaped reflector, to enable visitors to see the plant in the evening during the flowering period.

The houses contain many economic plants, ferns, cycads, and palms. A plant of *Encephalartos longifolius*, about 20 feet high, is reputed to be of great age. I also noticed a fine plant of *Dracæna Draco*, perhaps 30 feet high, branching into three towards the summit.

The collection in the open is not extensive, the system of classification being that of Luerssen. Many of the labels which I found upon examination to be made of paper, varnished over, and secured in iron frames, were quite obliterated. Aquatic plants are grown in tubs.

The Director, Prof. Hugo de Vries, kindly received me and showed me the Museum collection, which is a small one used for teaching purposes. Among the specimens brought to my notice were some natural flowers recently received from Dr. Herzfield and Co., Köln, very well preserved, but which appeared to have been made up with wax, &c. They had been preserved by a patent process of Prof. Pfitzer, of Heidelberg.

The preservative solution used here is identical with that employed at the Museum of the University of Ghent, and is considered by Prof. de Vries to be very satisfactory.

For sealing glass disks to bottles paraffin is used and answers the purpose well, it is certainly an improvement upon the Kew method in several respects and takes far less time to apply.

Within a short distance of the Botanic Garden are the Zoological Gardens, which contain a large and important Ethnographical Museum. I went carefully through this collection, but did not note any specimens suitable for Kew. Scientific names were comparatively rare.

The docks are very extensive and scattered, but as the time at my disposal had been expended I was unfortunately obliged to return without visiting them.

Miscellaneous Notes.

In the neighbourhood of Ghent I observed from the train several small patches of tobacco, and in one instance a drying shed with the hands of tobacco suspended from the outside of the building.

When at Antwerp I took the opportunity of visiting the extensive docks. I observed here enormous quantities of cotton and jute being unshipped from India, also American wheat, black and green 'crin végétal' (*Chamærops humilis*, L.), maize, rape, and poppy seed in bags, large quantities of cork cuttings in sacks, pillow-shaped bales of Russian flax packed in *Tilia*-bast and roughly sewn with rope. I also observed many cases of "new season's China tea congou," sewn up in matting and stencilled outside.

The timber docks are well worthy of a visit. Chiefly to be noticed here were large baulks of pine and oak stems, the latter being cut into sections of about 8 feet, also large quantities of deals of various sizes down to small staves, which are probably used for match-making.

It may be interesting to record the presence of large quantities of paper-making machinery from Norway, together with rough cardboard, probably from the same source.

The granary is an enormous structure, the grain being conveyed into it by machinery. The elevator can be raised or lowered according to requirement. At the bottom of the elevator is a fly-wheel which revolves with great rapidity and forces up the grain, and at the top is an opening from which much of the dust escapes during the operation.

In the neighbourhood of Dordrecht were noticed large quantities of vegetables under cultivation, many of which, I was informed, found their way into the London market. I observed that the gardens were effectively fenced in with a material I had not seen so employed before, and found upon enquiry that it consisted of the stems of *Phragmites communis*, Trin., supported by willow saplings; afterwards I noticed the same material being harvested and so used in many parts of Holland.

It was interesting to observe large quantities of *Boletus edulis Cantharellus cibarius* and *Agaricus campestris*, exposed for sale in the markets of Brussels.

The ditches in many parts of Holland contained a luxuriant growth of *Azolla caroliniana*, which first made its appearance about ten years ago, and which, I am given to understand, fruited for the first time this year.

In many places on the Dunes, where the sand had been bared by the wind, *Psamma arenaria*, R. & S., had recently been planted in tufts about 1 foot apart. Somewhat stunted Scotch fir (*Pinus sylvestris*, L.) and sea buckthorn (*Hippophae rhamnoides*, L.) were the chief woody plants on the Dunes, near Leyden.

Being in the immediate neighbourhood of the nursery of Messrs. Krelage and Son, at Haarlem, I called upon them, and was very kindly received by one of the principals, who readily conducted me over the establishment. The shade for the houses consisted of matting formed of the stems of *Phragmites communis*, mentioned above. It is prepared in the neighbourhood, and after about three years' service is cut into shorter lengths and employed for fencing.

J. M. HILLIER.

DCVI.—VANILLA IN SEYCHELLES.

The cultivation of vanilla in Seychelles appears to be at present in a comparatively prosperous condition. Information regarding the industry has been published in the *Kew Bulletin*, 1892 (pp. 111, 120, with plate, p. 214) and 1897 (p. 113).

Further information is taken from the Annual Report for 1896 (*Colonial Reports*, Annual, No. 214, 1897), by the Administrator, Mr. H. Cockburn Stewart:—

"The vanilla crop of last year is the largest that has ever been grown in Seychelles—63,000 lbs. The prices ruling during the year on the London and Paris Markets have also been most favourable, and the value of the crop has been declared at Rs. 936,000.

"The large output of vanilla has given a fresh impetus to its cultivation and a very large quantity has been planted during the past year.

"When the country is opened up by means of roads, as will shortly be the case, many acres of vanilla land will no doubt be taken up which at present are uncultivated, owing to the difficulty of transport.

"In one district alone, the Mare aux Cochons, to which a new road will be opened, there are about 5,000 acres of virgin soil well suited to vanilla.

"The cultivation of vanilla only dates back to about 20 years ago, and is only now beginning to be thoroughly understood.

"The Mexican system of allowing the vines to grow under trees nearly wild is almost universally adopted at present, and is a decided improvement on the old system of training the vine on artificial supports. I trust that the new mode of cultivating it will go far to ensure regular crops. Nothing pays better than vanilla. Its production costs the planter Rs. 3 per pound, and as prices vary from Rs. 8 to Rs. 16 the pound, a net profit of from Rs. 5 to Rs. 13 is the result. This year the average price was Rs. 15 the pound. The yield may be taken to be 200 lbs. an acre.

"Taking therefore an average of Rs. 10, an acre of vanilla should produce Rs. 2,000.

"Most of the land in Seychelles is in the hands of private owners, and it is difficult to estimate its cost, but it may be taken that land can be bought at from Rs. 100 to Rs. 200 the acre. It has been stated that landowners are reluctant to part with their land, but I do not apprehend much difficulty on this score provided that purchasers are prepared to pay ready money.

"There is some land belonging to the Government well adapted for vanilla cultivation which can be leased for periods varying from 9 to 21 years.

"Seychelles is unfortunately almost a *terra incognita*, for I cannot help thinking that if the scores of young Englishmen who leave the mother country year after year for other lands knew of it, they would give the preference to an English colony which offers advantages not to be met with elsewhere for the investment of small capital, say £1,000."

The following correspondence has since passed in regard to the quality of Seychelles vanilla :—

Colonial Office to Royal Gardens, Kew.

Sir, Downing Street, December 6, 1897.

I am directed by the Secretary of State for the Colonies to transmit to you, for your information, the enclosed copy of a despatch from the Administrator of the Seychelles Islands, forwarding a specimen of vanilla, grown on one of the estates in those islands.

I am, etc.,
(Signed) H. Bertram Cox.

The Director,
Royal Gardens, Kew.

[Enclosure.]

ADMINISTRATOR of the SEYCHELLES to COLONIAL OFFICE.

Government House, Seychelles,
October 16, 1897.

SIR,

I have the honour to inform you that I have forwarded to you by this mail a specimen of vanilla, which was given to me by Mr. D'Emmerez, the owner of Amitee Estate, Praslin, and which is one of the finest samples of vanilla I have seen.

I went through this estate when lately at Praslin and was much struck with its appearance and that of the neighbouring estate "Cote d'Or," which last year produced about £5,000 worth of vanilla.

Some of the Seychelles vanilla sent home last year was pronounced by experts to be the finest ever seen on the London market, and the bundle I am sending will show how well the preparation of vanilla is now understood in the Dependency.

I have, etc.,
(Signed) H. COCKBURN STEWART,
Administrator.

The Right Honourable
J. Chamberlain, M.P.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, December 28, 1897.

I have the honour to acknowledge the receipt of your letter of December 6, transmitting a sample of vanilla grown in the Seychelles.

2. I now enclose, for the information of the Secretary of State, a commercial report upon it.

I am, etc.,
(Signed) W. T. THISELTON-DYER.

H. Bertram Cox, Esq.,
Downing Street, S.W.

[Enclosure.]

Report by Mr. A. C. Meyjes, of the *Chemist and Druggist*, on a sample of vanilla grown in Seychelles, and received through the Colonial Office, December 7, 1897:—

"The pod you have sent is an unusually fine and long one. Vanilla of this character would probably realise about 26*s.* or 27*s.* per lb. gross in the London market at the present time. From that figure must be deducted certain trade allowances, brokerage, &c., amounting altogether to about 10 per cent. But your friends should be careful to tie the vanilla together in bundles containing pods all of the same length, or at least not varying more than ½-inch, because the pods are paid by length as well as by appearance. And further, I am afraid that the prices of vanilla are on the decline. They have been unusually high this year, and after Christmas the trade demand is apt to drop. Moreover, vanilla-growing must have been a very profitable business during the past few seasons and the usual result, viz., over-production is sure to follow. Strange to say, vanillin (the coal-tar product) has never been so cheap as now. The consumption of vanilla pods, however, is increasing every year and likely to continue to do so for a long time."

DCVII.—MISCELLANEOUS NOTES.

MR. GEORGE A. BISHOP has been appointed by the Secretary of State for the Colonies, on the nomination of Kew, Superintendent of the new Public Garden established at Bermuda by the Public Garden Act, 1896, "to assist in developing the agricultural and horticultural capabilities" of the colony, upon which its prosperity largely depends. Mr. Bishop has had twenty-three years practical experience in every branch of gardening, and was lately head gardener and steward at Wightwick Manor, near Wolverhampton. He has, besides, considerable other attainments which seem peculiarly to fit him for the varied duties of his new post. He passed fourth in honours in the examinations of the Science and Art Department in Practical Chemistry. He gave lectures on horticultural subjects under the Wolverhampton Corporation, and appears to have been successful in raising the standard of the industry in the district.

Botanical Magazine for March.—All the plants figured are in cultivation at Kew. *Camptosema pinnatum* is a shrubby leguminous plant from Brazil, whence seeds were sent to Kew by Dr. Glaziou, formerly Director of the Passeio Publico, Rio de Janeiro. The flowers are two inches long, and are bright red-purple. *Erythronium Hartwegi* is a Californian species which has been in cultivation at Kew for a long time. It is closely allied to *E. grandiflorum*. *Dracæna godseffiana* was first sent to Kew in 1892, by Mr. Henry Millen, Curator of the Botanical Station at Lagos. The species is nearly related to *D. surculosa*, which it resembles in its subscandent habit and spotted leaves. The drawing in the "Botanical Magazine" unfortunately does not represent the best variety, which has much darker green leaves, with more numerous spots. *Hacquetia Epipactis* is a curious umbelliferous plant, native of South Europe and Siberia. The flowers are yellow, in simple umbels, surrounded by an involucre of rather large green bracts. Nothing is known as to its introduction into the Royal Gardens, where it has been cultivated for many years.

Botanical Magazine for April.—*Allium Schuberti*, a species which is widely distributed in western Asia, has long, broad leaves and rose-red flowers on remarkably long pedicels; the umbels being nearly eighteen inches in diameter. Bulbs were sent to Kew by Messrs. Herb & Wulle, Nurserymen, Naples, in 1896, and flowered in June, 1897. The luxuriant variety of the pretty *Myosotis dissitiflora* figured, was communicated by E. J. Lowe, Esq., F.R.S., who desired that it should be named after Mrs. Thiselton-Dyer. The native country of the species is not positively known, but it is believed to be Switzerland. *Crocus Malyi* is a native of the Dalmatian mountains, where it was discovered more than fifty years ago. The flowers are white or straw-coloured, with a yellow throat. Corms were

presented to Kew by G. Maw, Esq., F.L.S., the author of the splendid monograph of the genus. *Rheum Ribes* is an old inhabitant of botanical gardens. It is ornamental both on account of its large leaves and its bright red fruits.

Flora of Tropical Africa.—Part 2 of Vol. VII., edited by the Director, was published in April. It contains the conclusion of Mr. Rolfe's enumeration of the orchids, and that of the *Scitamineæ* and *Irideæ*, by Mr. Baker.

Flora of Simla.—Since his retirement from active service, Colonel Sir Henry Collett has devoted much of his time to preparing at Kew a Flora of Simla and the adjacent district. Simla itself is situated at an elevation of about 7,000 feet, and the area included gives a range of altitudes from 3,000 feet in the valleys to 10,000 feet the summit of Huttoo, hence the vegetation is highly diversified. Including ferns and a few other vascular cryptogams, the total number of species is estimated at about 1,500. The work, which is well advanced, is to be illustrated by 200 figures in the text, all uniformly half natural size, reduced from drawings, by Miss M. Smith, of natural size. Sir Henry has presented the first portion of the original drawings to Kew.

Didierea mirabilis.—As long ago as 1880 the late Dr. H. Baillon described (*Bull. Soc. Linn. Par.* i., p. 258) *Didierea madagascariensis*, one of the most singular plants which the botanical exploration of Madagascar has yielded. In consistence and appearance it resembles some of the large prickly columnar *Cacti* ; and the structure of the unisexual flowers is so anomalous that the author took some years to decide upon its position in the natural system.

A second species, *D. mirabilis*, was described (*Bull. Mus. Hist. Nat.* Par. i., p. 23) by the same botanist in 1895. This is very different in habit from the other, being a miniature tree, with a very short trunk, and long, thick, cylindrical branches, giving it the appearance, at a distance, of a huge *Lycopodium*. Both species inhabit the coast region of south-western Madagascar ; *D. madagascariensis* growing gregariously in arid plains near Tulear, about 23° S. lat., and the other in the plains of Morondava, about three degrees further north. Mr. Alfred Grandidier, the editor of the sumptuous and comprehensive work on the Natural History of Madagascar, in course of publication by the French Government, appears to have discovered *D. madagascariensis*, and the genus was dedicated to him. At least Baillon says :—"Je donne ce nom à une curieuse plante de Madagascar, observée par M. A. Grandidier, non loin de Tuléar." *D. mirabilis* was discovered by a Mr. Grevé, and Mr. Grandidier procured the seeds from which a few plants were raised in the garden of the Paris School of Medecine. This garden, by the way, has been abolished and the plants dispersed. Thanks to the kind offices of Mr. A. Franchet, President of the Botanical Society of France, and the concurrence of Professor Blanchard, Dr. Baillon's successor at the Faculté de

Medecine, Kew now possesses a healthy young plant of *D. mirabilis*. It should be mentioned, however, that the plant was actually presented by Mr. A. Grandidier, to whom the whole batch belonged. The accompanying figure, kindly lent by the proprietors of the *Gardeners' Chronicle*, though not really a portrait of the Kew plant, very well represents it. In this state the very short lateral branches or "cushions" bear three or four sharp spines and as many very narrow, almost cylindrical, fleshy leaves, overtopping the spines.

DIDIERA MIRABILIS: Seedling plant. 8 inches high.

Figures of the adult state are given in Baillon's *Histoire Naturelle des Plantes de Madagascar* (a part of Grandidier's work referred to above), plates 261–2 and 262A. -- 262D.; and those representing habit are reproduced in the *Bull. Mus. Hist. Nat. Par.*, i. (1895), pp. 216–217. The genus is now referred to the Sapindaceæ.

"The Last of its Race":—This must be the epitaph on all that remains of an interesting "Cabbage tree," that has just disappeared from the flora of the island of St. Helena. It was originally described by Sir Joseph Hooker under the name of *Psiadia rotundifolia*, and figured by Melliss in his work on St. Helena, t. 41. Melliss wrote in 1875, "this plant had almost been classed with the extinct species, until, after long and patient search, I experienced the great delight of discovering *one* tree of it in the Black field at Longwood Gate. It is an old tree, probably the only one alive anywhere, and likely soon to follow the fate of the 'ebony' and 'stringwood,' both of which, after much seeking for them, I am inclined to believe exist no longer."

The ebony mentioned above was *Melhania melanoxylon*, Ait. It existed in European gardens after it had become extinct in St. Helena, but is apparently now completely lost. The stringwood was *Acalypha reticulata*, Muell. Arg., described by Melliss as "a beautiful little plant that formerly grew on the main central ridge amongst ferns and cabbage trees about the locality of Casons . . . but it is no longer there."

Psiadia rotundifolia was figured in the *Gardeners' Chronicle*, 1888 (I.), pp. 180, 181, and referred to as follows:—

"The interest attaching to the tree is that it is the last existing representative of its race in the island of St. Helena. Formerly, doubtless, there were many more, but goats and the destructiveness of man have destroyed this, and many other species peculiar to that remote islet. As in point of structure it possesses peculiarities of its own, it is evident that the loss of such a tree is equivalent to the tearing out of a page of a record, or, to suit the Philistine mind, let us say the destruction of a page of a ledger. In this country, indeed, generally, composites are herbs, or at most bushes. Asters, Senecios, Daisies, Chrysanthemums, Dahlias, as all know them in our gardens, are not to be classed with trees, but here we have a plant nearly allied, generally, to Aster, which forms a good sized tree with spreading naked branches, bearing small, stalked, spathulate, toothed leaves crowded towards the ends of the branches, and which leave when they fall very prominent cicatrices. The heads of flowers are borne in dense clusters, as shown in the smaller illustration. The tree in question is about 20 feet high, and grows near the entrance gates of Longwood, the place of the enforced retirement of Napoleon, who must often have seen it."

The Assistant Director of Kew who visited St. Helena in 1883, and wrote a report on its agricultural resources for the Colonial Office—(African No. 275, C.O., January, 1884) contributed the following further particulars to the *Gardeners' Chronicle*, 1888 (I.) p. 211.

"The interesting plant recently figured and described is, I regret to say, not represented at Kew. It is true, as you mention, that I brought seed from St. Helena in 1883, but none of it germinated. The same result attended the seed taken to Jamaica, and also some sent to Ceylon and Southern India. It is very probable, as suggested by Professor Oliver, that some of these 'Cabbage trees' are sub-dioecious, and if this is true as regards the plant under notice there is little hope of perpetuating it by seminal reproduction. This view is in some measure confirmed by the fact that no plants have been raised from seed sown in the island, and also by an experiment which the late Governor Janisch carried out on the spot. The ground near and under the tree was enclosed by hurdles, and the soil broken up and carefully prepared in the hope that some few well ripened seeds would fall upon it and germinate. Not a single plant was thus raised. I have only to add to your excellent description of this plant, that the flowers, which are plentifully produced in May or June, are small ($\frac{1}{2}$ inch diameter) and white, with a yellow centre."

The news of the death of the tree was announced in a letter from His Excellency the Governor, dated October 29th, 1897 :—

"You will be sorry to hear that the old *Psiadia rotundifolia* at Longwood, the last of its race, was blown down in some recent gales. I tried every plan I could think of to propagate it but without success, slips in the ground and in water bottles, and grafting on gumwood stocks, and seeds, but all in vain. Would you like a specimen of the wood? though I think you have a piece at Kew. It is plain white without veins, and extremely heavy."

The specimen of the wood kindly offered by Mr. Sterndale was received at Kew a few days ago, and this relic of the last living specimen of *Psiadia rotundifolia* is deposited in the Timber Museum (No. 3).

Sararanga sinuosa.—The Rev. R. B. Comins has sent another small collection of dried plants, chiefly from the Solomon Islands, and including a short branch and mature female inflorescence of this singular member of the Pandanaceae. (See *Kew Bulletin*, 1895, pp. 159-161 and 273.) There is also a male inflorescence, which was previously unknown; but it is in a very advanced stage, and almost destroyed, unfortunately, by insects. Still it is sufficient to give an idea of its appearance, and some perfect flowers have been found amongst the remains which will enable the diagnosis of the genus to be completed. Mr. Comins also claims to have discovered that the leaves are quadrifariously arranged—not spirally, as in *Pandanus*; and the branch he sends confirms his statement. Further figures will be given in *Hooker's Icones Plantarum*.

Aluvilla.—*Rhus juglandifolia*, Willd., as limited in the latest monographs, is usually a tree of moderate size, native of Western America, ranging from Mexico to Peru, and inhabiting mountainous districts up to at least 3,500 feet above the level of the

sea. Galeotti describes it as a beautiful shrub, having pale yellow, fragrant flowers, growing in woods in the Cordillera of Vera Cruz, at an elevation of 3,000 feet. Birschel designates it a large tree, growing at an altitude of 3,500 feet, near Guarenas, in the province of Caracas, and bearing the name of "Manzanillo Bovo." Spruce, who collected it at Baños, Quito, has the following note: "Arbor patula, 40–pedalis, lactescens, *haud* resinoso-aromatica. Flores albi. *Alubilla*, Quitensium." Purdie, who collected it in New Grenada, states that it is "the celebrated Palo Petro-Fernandez"; and on another label he describes it as a large forest tree. There are specimens in the Herbarium from several other collectors and localities, but they are unaccompanied by any remarks. Ernst (*La Exposicion Nacional de Venezuela en* 1883, p. 215) enumerates *Rhus juglandifolia* among woods and timbers, under the vernacular name of "Manzanillo de Cerro." Not one of the foregoing Spanish names is given in Seemann's *Die Volksnamen der Amerikanischen Pflanzen*, and we have found no published account of its possessing poisonous properties, which, from its popular name "Manzanillo" (Manchineel) might have been expected. But some months ago Mr. J. V. Sigvald Muller, of Guayaquil, sent to Kew fruiting branches of *Rhus juglandifolia*; one parcel named "Aluvilla blanca," and another "Aluvilla negra." There were slight differences in the foliage, but we could find nothing to distinguish them specifically. Mr. Muller, however, is of opinion that they are distinct, and states that both have the reputation of being exceedingly venomous. So far as we understand, his information was all derived from hear-say, and is merely traditional. Indeed he states that he had met none except Indians who even knew the name "Aluvilla." There may be a grain of truth in the tradition, though it is almost certain that *Rhus juglandifolia* is not harmful to Europeans.

Fungus from indigo refuse.—Professor C. A. J. A. Oudemans has recently called attention (*Versl. Konikl. Akad. Wetensch. Amst.* IV., 89 (1897), to a new species of edible fungus, *Verpa indigocola*, Oudem., from Klatten, Java, which grows abundantly on the débris of *Indigofera tinctoria*, after the colouring matter has been extracted. The native name of the fungus is "Djamoer tom," which signifies indigo-plant fungus. A specimen received from the Haarlem Colonial Museum proves to be a species of *Coprinus*.

Books presented by the Bentham Trustees.—In addition to about twenty serial publications, received in exchange for *Hooker's Icones Plantarum*, the Bentham Trustees have from time to time made important gifts of books. The most recent acquisitions from this source are mostly fifteenth, sixteenth, and seventeenth century books. Among them are the *editio princeps* of the *Opus Ruralium Commodorum*, of Crescenzi, 1471; a good copy of the same author's *De Agricultura omnibusque plantarum et animalium generibus, libri* xii., &c., 1518; an excellent copy of

Der Herbary oder Krüterbuch, genannt der Gart der Gesundheit, Strassburg, J. Prüss, 1507; *Fuchsii Plantarum Historia*, 1551; Worlidge's *Systema Horticulturæ*, 1682; and Bacon's *Sylva Sylvarum*, 1627. An interesting book of more recent date (1732) is *The Flower Garden Displayed*. The continuation of the long descriptive title reads:—"In above four hundred curious representations of the most beautiful flowers, regularly disposed in the respective months of their blossom, curiously engraved on copper plates from the designs of Mr. Furber and others, and coloured to the life, with the description and history of each plant, and the method of their culture, whether in stoves, greenhouses, hot-beds, glass-cases, open borders, or against walls. Very useful, not only for the curious in gardening, but the prints likewise for painters, carvers, japaners, &c., also for the ladies, as patterns for working and painting in water colours, or furniture for the closet." Another work presented by the Trustees is Poiteau's magnificent *Pomologie Française*. This comprises four large quarto volumes containing 431 plates, which were issued separately, with text, at a franc and a half each, between 1838 and 1846. The drawing is perhaps equal to anything of the kind, and far superior to most; and the colouring of the fruit is generally good, but of the leaves somewhat too uniformly blue-green, the ground being coloured ink. Brookshaw's *Pomona Britannica*, of which Kew possesses a fine copy of the large edition, surpasses Poiteau in colouring, but does not equal it in drawing.

Mexican Works on Botany, Materia Medica, &c.—The Kew Library has received a valuable gift of books from the Secretaría de Fomento, Mexico. In 1787 an expedition was organized for the scientific exploration of Mexico and other parts of America under Spanish dominion, and Martin Sessé, a botanist, was nominated its leader. J. M. Mociño and V. Cervantes were associated with him in the botanical work; and the two volumes entitled *Plantæ Novæ Hispaniæ* and *Flora Mexicana* are from manuscripts left by Sessé and Mociño. Their interest now is little more than historical, as most of the specimens described as new have already been published by other botanists, and many of the identifications are obviously erroneous. A useful work is the *Biblioteca Botanico-Mexicana*, by Dr. N. León; it contains titles of works and references to publications little known in Europe. *Datos para la Materia Medica Mexicana* (primera parte) is an illustrated book, which will be very serviceable in identifying Mexican drugs and connecting them with their native names. *Monografias Mexicanas de Materia Medica*, *Anales del Instituto Medico Nacional* and *El Estudio* are serial publications treating largely of medicinal plants.

Moth Borers in Sugar Cane.—In the *Kew Report*, 1876, p. 26, mention is made of the ravages of the larva of a moth among the sugar canes of British Guiana. It was identified as *Phalæna saccharalis* of Fabricius, but regarded as the same as *Diatræa*

sacchari of Guilding, who described it in 1828 from specimens found in the Island of St. Vincent. There is a brief notice, with figures, given in the *Kew Bulletin*, 1894 (pp. 152 and 175). A fuller account, with a bibliography, is that of Mr. T. D. A. Cockerell in the *Jamaica Bulletin*, April, 1892. Both in the *Kew Report* cited above and in standard works dealing with the subject it has been suggested that this species also infests sugar canes in Mauritius and other parts of the East Indies. Some confusion in consequence has arisen in regard to its distribution.

According to a note in the *Comptes Rendus* (cxxv., 1897, pp. 1109–1112), by M. Edmond Bordage, Director of the Museum in the Island of Réunion, the Old World moth borer is *Diatræa striatalis*, Snellen. This, it is said, was originally introduced from Ceylon into Mauritius in 1848 with sugar canes. It is now widely spread in the East Indies.

The distinction between *D. saccharalis* and *D. striatalis*, we are informed by Mr. W. F. Blandford, F.Z.S., was established by Snellen in *Mededeelingen van het Proefstation voor Suikerriet* in West Java (1890, pp. 94 *et seq.*, tt. i. and ii.) ; also in *Tijdschrift voor Entomologie* (xxxiv., 1892, p. 349, t. xix., figs. 1–4).

It would appear, therefore, that *D. saccharalis* is of New World origin, but apparently not now entirely confined to that hemisphere. It may have been "the worm eating the sugar canes" recorded by Hans Sloane in Jamaica in 1725. It has since been found in nearly every part of tropical America, while in the United States it attacks not only sugar cane, but also maize and sorghum. According to Cotes it is reported as "injuring sugar cane" in India.

D. striatalis, on the other hand, is apparently entirely an Old World species. It has not hitherto been recorded from any part of the New World, but in the interchange of sugar cane plants from one side to the other there is little doubt it will eventually be introduced there. Its present area of distribution includes Ceylon, Mauritius, Java, Singapore, Sumatra, and Borneo.

M. Bordage draws attention to yet another sugar cane borer in *Sesamia nonagrioides*. This was first observed attacking maize in Central France, and afterwards, also on maize, in Spain. In Algiers it attacked both sugar cane and sorghum. It may prove to be the sugar-cane borer of the Canary Islands (*Kew Bulletin*, 1894, p. 177). Snellen describes a variety, *albiciliata*, as attacking sugar cane in Celebes and Java. From the latter it is supposed to have been introduced to the Mascarene Islands and Madagascar.

Spurious St. Ignatius Beans.—Under the name of "Ignatia amara Beans," from Matto Grosso, Central Brazil, some broken seed pods were recently submitted to Kew for determination. It was at once evident that they were not the produce of *Strychnos Ignatii*, Berg—a large climbing shrub of the Philippines, which furnishes all the St. Ignatius beans of pharmacists. They were evidently portions of winged pods of a leguminous plant belonging to the tribe *Dalbergieæ*. Upon cutting through these pods they were found to be highly charged with a pale yellowish fluid balsam, and upon further comparison there was but very little

difficulty in identifying them as portions of the pods of *Pterodon pubescens*, Benth. The reason for the application of the obsolete Linnean name, *Ignatia amara*, to these pods is not far to seek, for it seems that the term "St. Ignatius Bean" is employed to designate the seeds of several medicinal plants in South America, and the species of *Pterodon* are included amongst them under the name of Fava de St. Ignacio.

Cupu-assu.—In a Report on the "Condition of tropical and semi-tropical fruits in the United States," in 1887, published by the United States Department of Agriculture (Division of Pomology Bulletin No. 1), the following account is given of a fruit with this name which had hitherto not been identified botanically.

Deltonea luctea (*sic*)—Native of Brazil, where it is called the "*Capu-assu*." It is a medium-sized tree, with immense thick foliage, so that in a grove of them it would be dark at noonday. The blossoms are small; the fruit an immense oval vessel, but often nearly round; a hard woody shell covered with a russet furze; inside, a yellow mass of pulp surrounding the immense seeds. When ripe, one of the fruits will most deliciously perfume the whole air. The flavour it is impossible to describe, but to drink the "wine of capuassu," which is simply the pulp washed off in water and strained with a little sugar added, is worth a voyage across the Atlanic" (Edward S. Rand).

The writer of this note was a resident at Para, and an occasional correspondent of Kew for many years. The news of his death was received with regret in the autumn of last year.

Deltonea lutea, Peckolt (*Hist. das Plant. Alimint. Brasil*, I., p. 119.), "Cupuaçu" is a name only. It does not appear in the *Index Kewensis*, and, as far as can be traced, no description has ever been published. The native name *Cupu-assu* or *Cupu-açu* is not unfamiliar in connection with Brazilian plants. It is given by Martius (*Flora Bras.*, XII., pt. iii., p. 76) as the local name of *Theobroma grandiflorum*, K. Schum., while in Burchell's MS. list in the Kew Herbarium (Nos. 9,367, 9,467, and 10,001) *Cupu-assu* and *Cupu-ähi* are referred to species of *Theobroma*. From Mr. Rand's description it is evident that the plant which yields the "wine of cupu-assu" does not belong to the Malvaceæ, as suggested by Peckolt, but to the genus *Theobroma*, in the nearly allied *Sterculiaceæ*, which includes the plant that yields the well-known cacao, or chocolate of commerce. The details supplied by Mr. Rand almost exactly apply to species of *Theobroma*, bearing woody-shelled fruits, such as those of *T. bicolor* or *T. martiana*. The seeds in *Theobroma* are usually embedded in a sweet and somewhat aromatic pulp, which, washed off and strained, with a little sugar added, would afford a palatable or even a delicious drink in hot countries. There are fruits of *T. martiana* in the Kew Museum from R. Spruce, marked *Cupu assu*, with the information that "the pulp is made into a preserve." They correspond in size, form, and outward appearance almost exactly with Rand's description.

G. Massee del.

Tea Blights.

Wyman & Sons. Ltd. Lith.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 138.] JUNE. [1898.

DCVIII.—TEA BLIGHTS.

(*With Plate.*)

The field of nature is one of incessant struggle. Every plant has to hold its own in the face of foes bent continuously and relentlessly on its destruction. If it succeeds it is only because its defensive resources are on the average superior to the attacks made upon it. The final result is one of equilibrium, in which foe and victim each manage to survive. This is arrived at through the interaction of conditions usually difficult to trace, but brought into adjustment after a long period of struggle.

When man appears on the scene and for his own purposes destroys the adjustment, the struggle begins anew with increased severity. He grows some one plant in wide stretches after clearing the ground of its competitors. But in so doing he relaxes the restraint of all its foes and often gives them a chance they have never possessed before.

Plants and their parasites have to live in nature as best they may. The host can do without the parasite, but the parasite cannot do without the host. A plant may exist alone in a forest and the parasite which kills it will find its own fate sealed if it cannot transfer its attacks to a neighbouring individual. The straits to which a parasite in consequence is put to continue its existence, and the varied means by which this is effected, form one of the most fascinating subjects of biological study. But the net result is that under natural conditions the parasite is kept in check.

When any crop is grown on a large scale it is obvious that the conditions are changed. A parasite having by accident fastened on an individual plant in a plantation and done its fatal work, can then extend, usually with little difficulty, to contiguous plants. Under such circumstances the spread of a fungoid disease can only be compared to a conflagration, which beginning on a small scale may increase to disastrous dimensions. Such troubles are part of the price which man has to pay for disturbing the order of nature. The only way to treat them is to endeavour

either to restore the natural checks which man has abolished, or, as this can from the circumstances of the case rarely be done, to substitute artificial ones in their place. And as a matter of practice, by an attentive study of the habits of the parasite, this can generally be effected and the injury it inflicts circumvented.

The difficulties which beset tea-culture in Assam are only an illustration of these general principles. But the Government of India does not possess any trained mycologist in its service, and no one was available for the study of the "Blights" which affect Indian tea-culture, but Dr. Watt, its Reporter on Economic Products. When a similar investigation was needed for the poppy crop, it was entrusted to a gardening member of the staff of the Royal Botanic Garden, Calcutta. Dr. Watt was obliged to have recourse to Kew for the technical investigation of the most serious maladies with which the tea-planters have to contend. The following report has been drawn up, from material transmitted by Dr. Watt, by Mr. Massee, a Principal Assistant in the Herbarium of the Royal Gardens.

Grey Blight.

(*Pestalozzia Guepini*, Desmaz.)

The amount of injury caused to the tea plantations by this fungus is estimated by Dr. Watt as follows:—"I regard the *Grey Blight* as very alarming, a disease that if not checked may easily reduce the productiveness of gardens by fifty per cent. It might, in fact, convert Assam from the prosperous province the planters have made it, to one of extreme distress."

An examination of the fungus sent from Assam on leaves of the tea plant, showed it to be identical with the parasite common on leaves of cultivated species of *Camellia* in Europe. The fungus first appears under the form of small grey spots, more or less circular in shape; these spots gradually increase in size and not infrequently run into each other, forming large, irregular blotches which often eventually cover the greater portion of the surface of the leaf. During increase in size, the spots are often bordered by a narrow dark line. The grey or sometimes white colour of the spots is equally evident on both surfaces of the leaf, and is due to the disappearance of the chlorophyll, and the subsequent death of the cells composing the tissue of the leaf. The mycelium of the fungus is very delicate, rarely exceeding 2μ in diameter, hyaline, and sparingly transversely septate; it at first occupies the intercellular spaces and runs between the cells, which eventually become separated from each other by a dense weft of mycelium. Finally the mycelium enters the cells and vessels in considerable quantity, causing the death of the invaded patches, the unattacked portion of the leaf remaining quite unchanged. When the leaf-tissue of the diseased patches is quite dead and brittle the mycelium of the fungus becomes aggregated in numerous dense tufts just beneath the cuticle, more especially on the upper surface of the leaf. On the tips of these aggregations of slender, erect hyphae, or conidiophores, which spring from a basal pseudoparenchymatous stroma, the conidia are borne. As these clusters of conidia increase

in size they raise the cuticle of the leaf into a series of minute warts, until finally the tension is too great, and the cuticle ruptures, usually in a triangular slit through which the mature conidia protrude and soon become free on the surface of the leaf, from which they are removed by wind or rain. Such of those as happen to alight on the moist surface of the leaf of a suitable host-plant, germinate at once, enter the tissues of the leaf, and form a new centre of disease, which in course of time produces conidia. By this rapid method of conidia-formation and distribution, it can be readily understood how possible and certain it is for the disease to spread rapidly when once introduced into a tea garden.

The conidia are produced at the apex of slender hyphae or conidiophores, and are very beautiful objects when seen under the microscope, being narrowly elliptic with somewhat pointed ends, and usually three-septate ; the two end cells are colourless, while the two median cells are olive-brown, the terminal colourless cell being surmounted by four very slender, colourless, spine-like processes longer than the conidium itself. The above-described is the typical and most abundant form of conidium ; variations occur in the number of septa, which range from two to four ; the hair-like appendages also vary from one to four, or are sometimes entirely absent.

The life-history of the fungus was ascertained from a series of cultures ; living conidia being obtained from the fungus growing on *Camellias* cultivated at Kew.

Conidia germinated freely within eighteen hours in hanging-drop cultures in ordinary tap water. The median dark-coloured cells of the conidia are alone capable of germination, each cell as a rule producing a single germ-tube ; in rare instances two germ-tubes spring from a cell, one of which remains rudimentary. On sterilised bread a dense white superficial mycelium soon appears, on the surface of which very minute dark points, consisting of groups of conidia are visible about the third day. Five days after sowing, the conidia are mature and capable of germination, but bread does not appear to be a very suitable medium for the cultivation of this fungus, the characteristic terminal, filiform appendages of the conidia being almost constantly below the number normally present, and in certain tufts entirely absent. The spineless condition of conidium agrees exactly with the fungus described by Cooke as *Hendersonia theicola*, parasitic on living tea leaves from Cachar, which is in reality nothing more than an abnormal form of *Pestalozzia Guepini*, and has also been observed on *Camellia* leaves at Kew. Examples of these abnormal spineless conidia, sown on plum-juice gelatine, gave origin to perfectly normal conidia within a week, in fact only normal conidia were produced on the last-mentioned nutrient solution, whether normal or exceptional conidia (in so far as the number of apical spines were concerned) were sown. It is quite an easy matter to inoculate living uninjured *Camellia* leaves by placing conidia on the damp under surface of the leaf, and keeping it moist for two or three days. No result was obtained when the conidia were placed on the upper surface of the leaf.

Pestalozzia Guepini is not known to possess any other form of fruit or mode of reproduction than the condition described above.

The disease under consideration is by no means new; specimens of tea leaves attacked by the *Pestalozzia*, now in the Kew Herbarium, are accompanied by the following note. "Tea leaves (blighted). Cachar. 1872 growth. A. H. Blechynden." A second lot of tea leaves, suffering from the same disease, is accompanied by a note as follows. "Leaves from a tea tree recovering from 'red spider.' Sap just beginning to run through them. This tree like many thousands has not given any leaf for three months. T. B. Curtis. Received from Mr. Blechynden, Calcutta, by T. B. C., October, 1878."

The fungus occurs as a parasite on leaves of plants belonging to the following genera:—*Camellia*, *Rhododendron*, *Citrus*, *Magnolia*, *Alphitonia*, *Niphobolus*, and *Lagerstrœmia*.

Owing to its wide distribution at the present day, the original home of the fungus is difficult to determine with certainty, but the amount of evidence at hand suggests an Eastern origin. In India it occurs on *Camellia* and *Rhododendron*; in Europe it is by no means uncommon, but always on introduced plants belonging to the two above-named genera. In the United States it occurs on introduced species of *Camellia* and *Citrus*, from which it may possibly have passed on to the native *Magnolia*. On the other hand, it occurs on indigenous plants (*Niphobolus*) in New Zealand, and on *Alphitonia* in Queensland.

Preventive measures.—If the diseased leaves were collected with the amount of care and intelligence exercised in collecting sound leaves, and burned at once after being collected, the disease would soon be stamped out, as the mycelium of the fungus is not perennial in the tea plant; consequently infection, and a recurrence of the parasite, depends entirely on inoculation by the numerous conidia or reproductive bodies of the fungus present on diseased leaves. Remembering the very different kinds of plants on which the fungus is known to be parasitic, it is very probable that it also occurs on wild plants growing in the vicinity of the tea gardens; if such proves to be the case, all such plants should be removed if practicable, as the conidia of fungi are carried considerable distances by wind, birds, and insects, and no amount of attention in the way of removing the parasite from the tea plants would avail, if the supply of conidia requisite for inoculating the tea plants were formed on other plants growing in the neighbourhood.

The name of the fungus, together with the synonymy, is as follows:—

Pestalozzia Guepini, *Desmaz.*, Ann. Sci. Nat., Ser. 2, XIII., 182, tab. 4, figs. 1–3 (1840).

Syn. *Pestalozzia inquinans*, Karst., Hedw., 1891, p. 301.
Pestalozzia Camelliæ, Passer., Rev. Myc., 1887, p. 146.
Coryneum Camelliæ, Massee, Grev., XX., 8 (1891).
Hendersonia theicola, Cooke in Sacc. Syll., IV., No. 2334 (1884).

Fig. 1, Leaf of tea plant showing the pale patches formed by "grey blight" (*Pestalozzia Guepini*); nat. size. Fig. 2, Section through a pustule of the fruit of the fungus; × 100. Figs. 3 & 4, Conidia of the fungus; × 400. Fig. 5, Conidia germinating; × 400.

Blister Blight.

(*Exobasidium vexans*, Massee).

The amount of injury caused by this parasite, along with an interesting account of its general appearance and mode of life, will be gathered from the following account by Dr. Watt:—"One of the very worst blights on tea is known to the planters as *Blister Blight*. At first it seemed to me as if this might prove a species of blister mite (*Phytoptus*), but I am now disposed to regard it as a fungus, and possibly a species of *Exoascus* or *Taphrina*. In tube No. 257 I have sent specimens of the disease in all stages, from young leaves showing translucent spots, to pieces of leaves showing well-formed circular blisters, also the further stages of the blisters appearing hairy (under the lens), and others turned quite black. The history of the disease is somewhat striking. It invariably appears on tea that has not been pruned in the autumn. About April it extends to the pruned tea, which has by then come into leaf. At first it looks like a minute pink spot, which, on being viewed through the leaf, is seen to be surrounded by a pale margin. This widens, and the upper surface of the leaf at this point becomes depressed into a circular pit that appears shining and moist. The under surface looks like a wart of a white, woolly appearance. These warts, as they enlarge, unite together and invade the shoots until the whole of the affected parts shrivel up. The woolly surface of the warts thus seems to be covered with white filaments, but I could never detect these as bearing spores. Shortly after this the leaves and shoots turn quite black, and fall to the ground. At this stage the tea plantation looks as if it had been burned. I have seen hundreds of acres completely ruined in this manner. But in two months or so, new shoots appear, and the blight is not seen again, as a rule, till next spring, and even then spasmodically, and where unpruned tea exists. It was very bad in the spring of 1895, and in 1897 I could not discover a bush with this blight in the very gardens where, at the time of my first visit, all operations had been completely stopped by it."

The view entertained by Dr. Watt as to the fungous nature of the parasite proved to be correct, microscopic examination showing it to be an undescribed species of *Exobasidium*, possessing features of interest from the mycological standpoint, more especially in the production of a dense layer of conidia which covers the surface subsequently occupied by the hymenium. The earliest indication of the disease is the appearance of translucent spots in the leaf, due to the disappearance of the chlorophyll and starch grains; this is followed by a rapid increase in the number of cells constituting the spongy parenchyma of the leaf and situated within the area occupied by the mycelium of the fungus.

The conspicuous blisters present on leaves that have been attacked for some time, are caused by the secondary increase in the number of leaf-cells over a limited area of the surface being resisted by the healthy unyielding tissues of the leaf; hence the abnormal growth, stimulated by the action of the parasite, assumes the form of a blister, being concave on the upper, and convex on the under surface of the leaf. When the points of infection are numerous on a leaf, the originally distinct blisters grow into each other during their development. The mycelium is very slender, not exceeding 2μ in thickness, sparingly transversely septate, and tinged with yellow when seen in the mass. It runs between the cells, which finally become much distorted and separated from each other. After becoming concentrated in clusters between the epidermal cells of the convex surface of the blister, on the under surface of the leaf, the mycelium ruptures the cuticle and appears on the surface of the blister under the form of minute, densely crowded clusters of hyphae. When the growth of the parasite is very vigorous the hymenium is not infrequently formed on both surfaces of the blister. Some of these hyphae run out into long, sterile filaments, giving a minutely downy or velvety appearance to the blister, when seen under a lens; the great majority of the hyphae, however, remain short, and produce a single conidium at the apex. The conidia are hyaline, or with a tinge of yellow when seen in the mass, elliptic with somewhat pointed ends, 1-septate, slightly constricted at the septum, straight, or sometimes very slightly curved, measuring $14–16 \times 5–6\mu$. It is not unusual to find conidia germinating *in situ*, each cell of the conidium producing one slender germ-tube. Mixed with the conidiophores are numerous basidia, but these are not sufficiently crowded and compact to form a typical hymenium, the surface of the tuft constantly remaining loose in texture, resembling the face of a brush rather than a waxy, compact surface. The basidia are subcylindric, and so far as observed, constantly produce two slender, spine-like sterigmata, although the presence of four daughter nuclei in some preparations of basidia stained with iodine-green, would seem to suggest the probability of four sterigmata being found in some instances. The spores are hyaline, continuous, glabrous, ovate-oblong, often slightly inaequilateral, $5 \times 3\mu$. When old, the tufts of hyphae appear to contract a little, thus becoming more isolated and distant from each other, and giving the hymenium a cracked appearance.

The branches do not appear to be disfigured to the same extent as the leaves by the parasite.

Preventive measures.—Remembering the statement by Dr. Watt that the disease "invariably appears on tea that has not been pruned in the autumn," it seems almost superfluous to suggest that autumn pruning should be carried out, unless there is some very strong reason for not doing so. The removal of diseased portions before the spores are mature would go far towards preventing a recurrence of the disease. Such infected parts should be burned, and not allowed to remain on the ground. Spraying would not, in all probability, be permissible, otherwise a solution of potassium sulphide (one ounce to three gallons of water) would prevent to a great extent the spread of the disease, if applied at the

time when it first appears. All known species of *Exobasidium* are parasites, forming blisters or galls on the leaves and branches of the host plant; the flowers and fruit are sometimes also attacked. Species belonging to the following genera are known to serve as host plants :—*Rhododendron*, *Vaccinium*, *Andromeda*, *Cassandra*, *Arctostaphylos*, *Ledum*, *Saxifraga*, *Laurus*, *Symplocos*, *Arrhenatherum*, and *Bromus*. The above list of genera belonging to widely separated orders of plants, suggests the possibility of some ally of the tea plant also serving as a host for the "blister blight," and if such exist in the forest adjoining the tea plantations, there is but little hope of eradicating the disease until such nurse-plants are removed from the vicinity.

The following is a diagnosis of the species :—

Exobasidium vexans, *Massee.*

Hymenophora innata, effusa, forma varia, vulgo orbicularia vel oblonga, in foliis infestatis bullas supra concavas infra convexas 4–12 mm. diam. interdum confluentes formantia. *Hymenium* leve, siccitate rimosum, initio pallidum, dein ætate albo-pruinosum. *Basidia* cylindracea 30–35 × 5–6 μ, 2-sterigmatifera; sterigmata aculeata, 3 × 0·5 μ. *Sporæ* ovato-oblongæ, continuæ, hyalinæ, glabræ, sæpe inæquilaterales, 5 × 3 μ. *Conidia* fusiformia, hyalina, 1-septata, ad septum leviter constricta, 14–16 × 5–6 μ.

On living leaves and branches of *Camellia Thea*. Assam.

Fig. 6, Leaf of tea plant, with blisters formed by blister blight (*Exobasidium vexans*); nat. size. Fig. 7, Section through a blister; × 100. Fig. 8, Portion of hymenium of same, showing numerous conidia, *a*, and basidia, *b*, bearing two spores each; × 400. Fig. 9, Free spores; × 400. Fig. 10, Conidia; × 400.

Thread Blight.

(*Stilbum nanum*, Massee).

This very remarkable fungus, while agreeing technically with the genus *Stilbum* in the structure of the conidiophore, differs very materially in the presence of an elaborately branched, sterile stroma composed of densely interwoven, slender, sparsely septate, vaguely branched hyphae, 2–3 μ in diameter, combined to form a thin, white membrane, which is inseparable from the bark or leaf on which it grows. This sterile felted mycelium often forms white patches several inches in length on the bark of living branches, and then breaks up into irregularly-branched slender strands, many of which are not thicker than thread, hence the planter's name "*thread blight*." The delicate white strands of mycelium run along the surface of the bark to the tips of the young shoots, branching and anastomosing irregularly: thence they not infrequently pass on to the leaves, where they form a yet more delicate, irregularly branched pattern. Microscopic examination of a diseased branch shows that the slender mycelium is at first most abundant in the cambium zone, and extends to the young wood, the vessels of which soon become choked with a dense weft of mycelium. A slight browning of the tissues indicates the progress of the mycelium. This internal mycelium passes through the substance of the bark, and gives origin to the superficial strands

of mycelium described above. The branches are eventually killed owing to the destruction of the cambium zone and choking of the vessels of the wood by mycelium. So far as can be observed from an examination of the ample supply of material forwarded by Dr. Watt, the fruit of the fungus is only produced after the branch on which it occurs is dead, when it appears on the surface of the bark under the form of miniature pins about half a line high, and of a pale yellow colour. These fruits generally occur in large numbers, giving to the branch a minutely velvety or hairy appearance as seen with the naked eye.

In the absence of living material it is impossible to state definitely in what manner the fungus first gains access to the interior of the living plant; but the general habit suggests the idea of its being a root-fungus, first attacking the slender rootlets, and afterwards extending into the above-ground portions of the plant. If mycelium is found in quantity on the thicker root-branches and about the base of the trunk, the above supposition would doubtless be correct, and would imply the presence of strands of mycelium in the soil; such strands probably traversing the soil and extending from one plant to another, as is known to be the case in other root-parasites, as *Dematophora Necatrix* and *Rosellinia radiciperda*. The fungus described above is in all probability only the conidial phase of some higher form, which, as is usually the case, only forms its fruit on thoroughly decayed portions of the host plant.

Preventive measures.—If examination, as indicated above, shows the fungus to be a root-parasite, a trench should be made round the base of the stem. as deep as practicable without injuring the roots, and filled with lime, or failing this, with wood ashes. Deep narrow trenches should be made enclosing batches of diseased trees, for the purpose of checking the spread of underground mycelium from diseased to healthy trees. Under any circumstances branches killed by the disease should be collected and burned, otherwise the conidia formed on such branches will be carried by wind and other agencies, and infect healthy plants. Care should be taken to ascertain whether the fungus is present on wild plants growing in the vicinity of the plantations, as no amount of care exercised on the tea plants to prevent the disease will avail if the fungus is present on other plants that grow near at hand.

The following diagnosis will enable the fungus to be recognized by a mycologist :—

Stilbum nanum, *Massee* (sp. nov.).

Conidiophora minutissima, vix 0·5 mm. alta, gregaria, flavida. *Stipites* æquales, tenues. *Capitula* globosa vel obovata. *Conidia* numerosissima, minuta, hyalina, continua, elliptica, muco primitus obvoluta, 5 × 2·5μ.

On living branches and leaves of *Camellia Thea.* Assam.

Fig. 11, Branch of tea plant attacked by "thread blight" (*Stilbum nanum*), showing the white sterile mycelium running over the bark, also the fruit of the fungus; nat. size. Fig. 12, Fruit of the same; × 100. Fig. 13, Section through a head of fruit, showing the conidia borne at the tips of the hyphae which form the head; × 400.

DCIX.—FUNGI EXOTICI, I.

The collections enumerated below have been recently received at Kew for determination. With the object of rendering possible a more exact knowledge of the geographical distribution of Fungi, lists of all the species communicated are given under their respective countries.

Spitzbergen.

The following fungi were detected on plants collected during the Conway Expedition by Mr. A. Trevor-Battye.

Pyrenomycetes.

Pleospora Drabæ, *Schröter, Nord. Pilz.* (1881) p. 15.
On *Braya alpina,* Sternb. et Hoppe, Red Mount.

Sphærella Agrostidis, *Auersw. Myc. Eur. Pyr.* p. 17, fig. 79, ex *Sacc. Syll.* i. (1882) p. 526.
On dead grass leaves.

Sphæropsideæ.

Septoria Saxifragæ, *Passer. in Rev. Mycol.* ii. (1880) p. 36.
On *Saxifraga Hirculus,* Linn., The Flower Garden, Advent Bay.

Diplodina Arenariæ, *Massee (sp. nov.). Perithecia* cæspitosa, subepidermica, ostiolo erumpentia, globoso-conica, contextu parenchymatica, fuscidula, 5 mm. lata. *Sporidia* elongato-clavulata, utrinque obtusiuscula, medio 1-septata, ad septum demum subconstricta, hyalina, curvula rectave, 25–30 × 6–7 μ ; basidia hyalina, 25–30 × 2–2·5 μ.

On pedicels and fruit of *Arenaria verna,* Linn., The Glen, Red Mount.

Distinguished from all known species of *Diplodina* by the large perithecia and spores. At first immersed, globose, and astomous, finally a papillate ostiolum developes and pierces the epidermis, and about half the entire perithecium becomes erumpent.

Coniothyrium arundinaceum, *Sacc. in Michelia* i. (1879) p. 203. Dane's Island. On fading leaves of *Phippsia algida,* R. Br.

China.

The interesting fungus described below was collected and communicated by Mr. George M. H. Playfair, H. B. M. Consulate, Ningpo, China.

Hyphomycetes.

Triglyphium niveum, *Massee (sp. nov.). Sporodochia* hypophylla, subeffusa, nivea, innato-erumpentia, 0·5–1 mm. lata. *Conidia* hyalina, breviter 3-radiata, 16–20 μ diam., radiis apice obtusatis.

Parasitic on leaves of *Machilus Thunbergii*, Sieb. et Zucc.; Ningpo.

The small, snow-white erumpent patches superficially resemble the work of some *Coccus*. Distinguished from *Triglyphium album*, Fresen., the only other species, by the conidia being larger and constantly 3-rayed.

India.

Specimens of fungi, accompanied in some instances by sketches or photographs, have been received from Mr. J. S. Gamble, M.A., F.L.S., Conservator of Forests, N.W. Provinces: Brigade-Surgeon J. E. T. Aitchison, M.D., C.I.E., F.R.S.; and Mr. G. Marshall Woodrow, F.L.S., Poona Coll. of Science.

Basidiomycetes.

Lepiota altissima, *Massee* (*sp. nov.*). *Pileus* membranaceus, albidus, centro tantum carnosus, e convexo-plano subumbonatus, squamis concentricis innatis subsquarrosus, ad marginem fimbriatus, fibrosus, circiter 8 cm. latus. *Lamellæ* liberæ, subconfertæ, albæ, dein pallide flavæ. *Sporæ* ovatæ, 8 × 5 μ; basidia subclavata, 28–30 × 8–10 μ. *Stipes* a pileo discretus, albus, cylindraceus, bulbillosus, fistulosus, tandem usque ad 25 cm. longus, apice vix 1 cm. crassus. Annulus persistens, fimbriatus.

Bombay. Growing in open pastures, near Poona, *Woodrow*, 22.

A very distinct species belonging to the group of *L. procera*. In all probability edible.

Collybia rupicola, *Massee* (*sp. nov.*). *Pileus* centro excepto submembranaceus, e campanulato expansus, fusco-cinereus, margine primitus subinvolutus, velutino-squamulosus, 2–4 cm. latus. *Lamellæ* postice attenuato-annexæ, distantes, albæ, dein griseæ, acie crenulata. *Sporæ* subglobosæ, hyalinæ, 5–6 μ. *Stipes* fistulosus, sursum attenuatus, pileo concolor, undique densissime lanato-hirsutus.

N. W. Provinces. Cæspitose, on naked rocks, Jehri Garhwal, alt. 7500 ft., *Gamble*, 25478.

Hymenochæte leonina, *Berk. et Curt. in Journ. Linn. Soc.* x. (1869) p. 334.

N. W. Provinces. On dead bark, Jaunsar, *Gamble*, 25701.

Lachnocladium himalayense, *Massee* (*sp. nov.*). *Truncus* crassiusculus, elongatus, 8–10 cm. circiter, pallide rufescens. *Rami ramulique* rugulosi, teretes vel subcompressi, axillis arcuatis, alutacei, dein cinnamomeo-fuliginei, apicibus pallidis ætate nigricantibus. *Sporæ* subglobosæ, hyalinæ, 4–5 μ.

Sikkim. On the ground in fir forests, Phallaloong Ridge, alt. 10000 ft., *Gamble*, 99.

Corticium cœruleum, *Fries, Hym. Eur.* (1874) p. 651.

N.W. Provinces. On old dry wood, emitting a phosphorescent light, Lachiwala Forest, Dehra Dun, *Gamble*, 25600.

Erinella corticola, *Massee* (*sp. nov.*). *Ascomata* 1–1·5 mm. alta, 0·5 mm. lata, gregaria vel subsparsa, primo globosa, dein erumpentia, planiuscula, extus puberula, albida, margine ciliato pallido, disco pallido vel ochraceo. *Stipes* brevissimus, cylindraceus, bulbillosus, albus. *Asci* cylindracei, 90–100 × 6–7 μ, iodo haud tincti. *Sporæ* hyalinæ, filiformi-fusoideæ, pluriguttulatæ, demum 9–11-septatæ, 55–60 × 1·5 μ. *Paraphyses* fusoideæ, ascis longiores, 3–4 μ latæ.

N. W. Provinces. On bark, Dehra Dun, *Gamble*, 25545.

Ustilagineæ.

Ustilago segetum, *Winter in Rabenh. Krypt. Fl.* i. (1814) p. 90. N. W. Provinces. Dehra Dun; on wheat, *Gamble*, 25681: on *Cynodon Dactylon*, Pers., 25680; on oats, 25682.

Ustilago olivacea, *Tul. in Ann. Sci. Nat.* sér. 3, vii. (1847) p. 88. N. W. Himalaya. On *Carex condensata*, Nees, *Gamble*, 25069.

Uredineæ.

Gambleola, *Massee* (*gen. nov.*). *Teleutosporæ* biloculares, concatenatæ, ex omnibus partibus arctissime coalitæ, columellam cylindraceo-elongatam efformantes, sporidiolis globosis hyalinis. *Uredosporæ* haud evolutæ.

Superficially resembling *Cronartium*, but differing in the teleutospores being two-celled, and in the absence of uredospores around the base of the column of teleutospores. *Masseella* differs in its teleutospores being one-celled, and not concatenate.

In the present genus, the teleutospores are for the most part two-celled, resembling those of *Gymnosporangium*, each cell having two germ-pores situated near to the median septum. Promycelium elongated, 2–3-septate near the apex, each cell producing a spherical, hyaline sporidium. Although the teleutospores are cemented together on every side, to form the column, yet when crushed they are seen to be arranged in parallel chains.

Gambleola cornuta, *Massee* (*sp. nov.*). *Columellæ* teleutosporarum gregariæ, cæspitosæ, cylindraceæ, filiformes, flexuosæ curvatæque, umbrinæ, usque ad 3 mm. longæ. *Teleutosporæ* oblongatæ, utrinque attenuatæ, 40–50 × 10–12 μ, ad septum vix constrictæ, fuscidulæ, loculis 2-poris.

N. W. Provinces. On living leaves of *Berberis nepalensis*, Spreng., Chakrata, alt. 7000 ft., *Gamble*, 24387.

The cylindrical sori of teleutospores are caespitose in tufts of 5–9 individuals, brown and somewhat flaccid when moist, becoming rigid and blackish when dry. Parasitic on the under, or very rarely on the upper surface of living leaves.

Uromyces Hobsoni, *Vize in Grevillea* iv. (1876) p. 115. *Sori* in maculas tumidas rubro-brunneas in Jasmini ramulis foliisque dense aggregati; sori in ramulis 1–4 cm. longi; sori in utrisque paginis foliorum plus minusve orbiculares, 2–4 mm. diam., subtus arcte concavi, supra convexi. *Teleutosporæ* ellipticæ, apice basique acutæ vel subobovatæ, dilute fulvæ, leves, pariete apice incrassato,

48–51 × 20–24 μ; pedicelli hyalini, æqualiter filiformes, 118–121 × 6–7 μ. *Æcidia* alba, circa 0·5 mm. diam., marginibus hinc inde fissis revolutisque. *Æcidiosporæ* hyalinæ, leves, globosæ vel ob pressionem irregulariter angulatæ, 14–15 μ diam.

BOMBAY. On *Jasminum sp.*, Kolapore, *Colonel Hobson.*

N. W. PROVINCES. Dehra Dun, *Gamble*, 25283.

In all the specimens examined the teleutospores are quite mature, nevertheless, on several patches, scattered æcidia are present, showing that these structures had preceded the teleutospore condition on the same patch.

Puccinia coronata, *Corda, Icon. Fung.* i. (1837) p. 6, t. 2, fig. 96.
N. W. PROVINCES. The æcidial form on living leaves of *Rhamnus purpurea*, Edgew., Deoban, alt. 9000 ft., *Gamble*, 24427.

Puccinia Graminis, *Pers. Disp. Fung.* (1797) p. 39, t. 3, fig. 3.
N. W. PROVINCES. The æcidial form on living leaves of *Berberis vulgaris*, Linn., Deoban, alt. 8000 ft., *Gamble*, 25779.

Puccinia fusca, *Wallr. Fl. Crypt.* ii. (1833) p. 220.
N. W. PROVINCES. The æcidial form on *Anemone rivularis*, Buch-Ham., Deoban, alt. 9000 ft., *Gamble*, 24409.

Melampsora Hypericorum, *Winter in Rabenh. Krypt. Fl.* i. (1884) p. 241.

N. W. PROVINCES. On living leaves of *Hypericum cernuum*, Roxb., Jaunsar, alt. 7000 ft., *Gamble*, 25711.

Melampsora epitea, *Thümen in Mitth. Vers. Oest.* ii. (1879) p. 1.
N. W. PROVINCES. On living leaves of *Salix elegans*, Wall., Deoban, alt. 9000 ft., *Gamble*, 24399.

Uredo Oldenlandiæ, *Massee* (*sp. nov.*). *Sori* minuti, amphigeni, maculas non formantes, 300–500 μ diam., sparsi vel inordinate gregarii, prominuli, epidermide primo tecti, tandem apice rupto pallide ochracei. *Uredosporæ* oblongæ vel obovatæ, episporio pro ratione tenues, ubique dense et minutissime echinulatæ, sessiles, raro pedicellatæ, hyalinæ, 20–25 × 10–12 μ.

N.W. PROVINCES. On living leaves of *Oldenlandia sp.*, Jehri Garhwal, alt. 4000 ft., *Gamble*, 25441.

The sori are pale ochraceous when dry, but are in all probability white when fresh, the spores are colourless. It resembles *U. Cussoniæ*, Cooke & Mass., in habit and general appearance, but differs distinctly in the spores.

Æcidium Clematitis, *DC. Fl. Fr.* ed. 3, ii. (1805) p. 243.
N. W. PROVINCES. On living leaves of *Jasminum humile*, Linn., Jaunsar, alt. 9000 ft., *Rogers.*

SPHÆROPSIDEÆ.

Catinula leucoxantha, *Massee* (*sp. nov.*). *Perithecia* sparsa, superficialia, 1–1·5 mm. diam., albida, disco concaviusculo humido plicato-cavernoso luteo. *Basidia* filiformia, 30 × 1·5 μ, hyalina, sporulis ellipsoideis utrinque acutissimis 8–10 × 2 μ hyalinis.

N.W. PROVINCES. On living leaves of *Leucas hyssopifolia*, Benth., Dehra Dun, *Gamble*, 24584.

Distinguished from all known species by the whitish exterior and irregularly lacunose, yellow disc. There are usually 2–4 perithecia on a leaf, mostly hypophyllous.

Hyphomycetes.

Fusarium pannosum, *Massee* (*sp. nov.*). *Sporodochia* erumpentia, 5–10 cm. diam., suborbicularia, sæpe confluentia, amœne cinnabarina, carnosa, compacta. *Hyphæ* repentes, dense intricato-ramosæ, parce septatæ, 4–5 μ crassæ, hyalinæ. *Basidia* parce ramulosa, ramulis fusoideis, conidiis fusoideo-falcatis utrinque acutissimis 3-septatis ad septa interdum constrictis 35–38 × 5 μ.

Punjab. On living trunk of *Cornus macrophylla*, Wall., Murree, alt. 7000 ft., *Aitchison*.

A very remarkable species, in some instances nearly covering the trunk, and thus forming a conspicuous object at some considerable distance away. Thick, felt-like, and somewhat gelatinous when moist, becoming much contracted and wrinkled when dry.

Straits Settlements.

Specimens sent to Kew for determination by Mr. H. N. Ridley, M.A., F.L.S., Director, Gardens and Forest Department, Singapore.

Basidiomycetes.

Lentinus blepharodes, *Berk. et. Curt. in Journ. Linn. Soc.* x. (1869) p. 301.

State of Selangor. On a stump.

Lentinus exilis, *Fries, Epicr.* (1838) p. 393.

Singapore. On dead wood, Botanic Gardens, *Ridley*, 10.

Fomes australis, *Sacc. Syll.* vi. (1888) p. 176.

Singapore. On dead wood, Botanic Gardens, *Ridley*, 2, 11.

Fomes semitostus, *Sacc. Syll.* vi. (1888) p. 200.

Singapore. On wood, Botanic Gardens, *Ridley*, 1.

Polystictus xerampelinus, *Sacc. Syll.* vi. (1888) p. 282.

Singapore. On wood, Botanic Gardens, *Ridley*, 12.

Polystictus flabelliformis, *Sacc. Syll.* vi. (1888) p. 216.

Singapore. On rotten wood, Botanic Gardens, *Ridley*, 9.

Polystictus sanguineus, *Fries in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 75.

Singapore. On dead trunks, Botanic Gardens, *Ridley*, 13.

Irpex flavus, *Klotzsch in Linnæa* viii. (1833) p. 488.

State of Selangor. Growing on the living trunks of coffee trees, and said to be the cause of a serious disease, attacking the plants at the collar, *Ridley*, 19.

Stereum nitidulum, *Berk. in Hook. Lond. Journ. Bot.* ii. (1843) p. 628.

Singapore. On the ground, Botanic Gardens, *Ridley*, 8.

Stereum vellereum, *Berk. in Hook. f. Fl. N. Zel.* ii. (1855) p. 183.

Singapore. On dead wood, Botanic Gardens, *Ridley*, 5.

Lachnocladium furcellatum, *Sacc. Syll.* vi. (1888) p. 738.

State of Selangor. On rotten wood, Batu Caves, *Ridley*, 19 bis.

Pyrenomycetes.

Xylaria Ridleyi, *Massee* (*sp. nov.*). *Capitulum* ellipticum vel obovatum, obtusum, durissimum, crusta fragili pallida tectum, in stipitem cylindricum deorsum abrupte attenuatum. *Perithecia* peripherica, ovata, immersa, ostiolis minutissimis immersis. *Asci* cylindracei, stipitati. *Sporæ* octonæ, oblique monostichæ, elliptico-naviculares, utrinque acutæ, sæpe curvulæ, 18–20 × 4–5 μ, opacæ, brunneæ.

Singapore. On dead wood, Botanic Gardens, *Ridley*, 15.

A very distinct and remarkable species, superficially resembling a stalked fruit. Capitulum broadly ovate or elliptical, obtuse, whitish, glabrous, 1–1·5 × 0·8 – 1 cm., ostiola barely visible under a lens. Stem about equal in length or slightly shorter than the club, 2–3 mm. thick, pale brown. Allied to *Xylaria dealbata*, Berk., but distinguished by the much less prominent ostiola of the perithecia, and the smaller spores.

Rosellinia picacea, *Massee* (*sp. nov.*). *Perithecia* dense gregaria, rarius sparsa, carbonacea, nigra, maculis albo-luteis ornata, ostiolo minuto vix prominulo hiante. *Asci* cylindracei, stipitati, apice subtruncati, octospori, circa 300 × 18 μ. *Sporæ* oblique monostichæ, fuscæ, ellipticæ, utrinque acutæ, 2-guttulatæ, 30 × 15 μ. *Paraphyses* septatæ, capitatæ, filiformes.

Singapore. On dead bark, Botanic Gardens, *Ridley*.

Perithecia 1·5 mm. in diameter, crowded and forming patches 2–3 cm. across. Superficially resembling a species of *Pertusaria*. Allied to *Rosellinia pachydermatica*, Cesati, but quite distinct from this and every other described species in the large spores, distinctly capitate paraphyses, and in the yellowish-white patches on the perithecium, which are sometimes raised above the general level of the surface, and consequently resemble warts.

Xylaria Hypoxylon, *Grev. Flor. Edin.* (1824) p. 355.
Singapore. On dead wood, Botanic Gardens, *Ridley*, 14.

Tryblidiella rufula, *Sacc. Syll.* ii. (1883) p. 757.
Singapore. On dead branches, Botanic Gardens, *Ridley*, 6.

Daldinia vernicosa, *Cesati et De Not. in Comm. Soc. Crittog. Ital.* i. (1863) p. 198.

Singapore. On logs, Botanic Gardens, *Ridley*, 4.

Kertzschmaria Heliscus, *Massee; Poronia Heliscus*, Mont. Syll. Crypt. (1856) p. 209.

Singapore. On dead bark, Botanic Gardens, *Ridley*, 7.

The present species is a genuine *Kertzschmaria*, and not a *Poronia*, as is proved by examination of a portion of Montagne's type, sent by him to Berkeley, and now in the Kew Herbarium. The Singapore specimens have the perithecia densely crowded, forming a continuous crust 15–20 cm. long and broad.

Hyphomycetes.

Tubercularia apiospora. *Dur. et Mont. in Expl. Sc. Algér. Crypt.* (1866–69), p. 333.

Singapore. On dead wood, Botanic Gardens.

Necator, *Massee* (*gen. nov.*). *Sporodochia* scutellato-disciformia vel convexiuscula, aurantio-rubra, erumpenti-superficialia, gelatinosa, conidiorum agglutinatorum strato tecta. *Conidia* oblonga vel ellipsoidea, continua, catenulata, demum plus minusve secedentia, plasmate aurantiaco.

A remarkable fungus without very obvious affinities, belonging to the Tubercularieæ-Mucedineæ, having continuous, brightly-coloured, catenulate conidia. The stroma or sporodochium is distinctly parenchymatous, erumpent and gelatinous, the superficial cells everywhere growing out into chains of conidia; the apical ones being the oldest, and becoming free as they mature, new conidia at the same time forming at the base of the chain.

Necator decretus, *Massee* (*sp. nov.*). *Sporodochia* disciformia, laxe gregaria, sessilia, erumpentia, 1–1·5 mm. diam., interdum oblonga, 2–2·5 × 1·5 mm., alba, dein aurantio-rubescentia. *Conidia* continua, ellipsoidea, catenulata, 14–18 × 7–8 μ.

STATE OF SELANGOR. On cultivated coffee trees.

Said to be a very destructive parasite, attacking the young branches, by commencing at the tips and working downwards. When the pustules first burst through the bark they are white, finally becoming orange-red, due to the formation of the conidia, the epispore of which is smooth and hyaline, but the contents orange-red. The general appearance of the fungus under a pocket-lens, is that of a minute *Dacryomyces* or *Orbilia*. It is said that by removing the injured branches, the spread of the disease is checked.

MYXOGASTRES.

Lycogala Epidendrum, *Rostaf. Monog. Mycet.* (1875) p. 285, t. 1, figs. 1 et 7–12.

SINGAPORE. On dead wood, Botanic Gardens, *Ridley*, 16.

BORNEO.

Fungi from the East Coast of British North Borneo, collected by Mr. C. V. Creagh, C.M.G., late Governor of Labuan.

BASIDIOMYCETES.

Marasmius erumpens, *Massee* (*sp. nov.*). *Pileus* e hemisphærico expansus, membranaceus, glaber, albidus, margine semper subinvolutus, vix 1 mm. latus. *Lamellæ* postice decurrentes, subdistantes, albidæ. *Sporæ* obovatæ, hyalinæ, 5–6 × 4 μ; basidia clavata, 25–30 × 4–5 μ. *Stipes* filiformis, glaber, albidus, basi tuberculo floccoso præditus.

Gregarious on fallen twigs.

Allied to *Marasmius sarmentosus*, Berk., but distinguished by the whitish, glabrous pileus.

Lentinus pergameneus, *Lév. in Ann. Sci. Nat.* sér. 3, v. (1846) p. 117.

On stumps and fallen branches.

The specimens are rather small in size, but possess all the characteristics of the species to which they are referred.

Panus conchatus, *Fries, Epicr.* (1838) p. 398.
Growing on fallen logs.

Polyporus lucidus, *Fries, Syst Myc.* i. (1821) p. 353.
On dead tree-trunks.

Fomes rugosus, *Sacc. Syll.* vi (1888) p. 152.
On dead wood.

Fomes australis, *Sacc. Syll.* vi. (1888) p. 176
On dead wood.

Fomes melanoporoides, *Sacc. Syll.* vi. (1888) p. 196.
On dead wood.

Polystictus membranaceus, *Fries in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 93.

On dead wood.

Polystictus Xanthopus, *Fries in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 75.

On dead branches.

British New Guinea.

The species enumerated below were collected by Mr. W. Fitzgerald, and communicated by Sir Ferdinand von Mueller, K.C.M.G., F.R.S., F.L.S.

Basidiomycetes.

Laccaria Hookeri, *Massee; Marasmius Hookeri,* Berk. in Hook. Kew Journ. Bot. iv. (1852) p. 136.

On rotten wood, Amaiama.

Agreeing exactly with Berkeley's type, collected by Dr. (now Sir) J. D. Hooker in Khasia, at an elevation of 6000 ft. The pileus is very tough and pliant when moist, becoming strongly incurved and rigid when dry. Gills broadly annexed, thin, margin entire, 5–8 mm. broad. The present species is a typical member of the genus *Laccaria*, Berk. & Broome, having the gills at maturity powdered with white, globose, warted spores, which measure 7–8 μ in diameter.

Lentinus infundibuliformis, *Berk. et Broome in Journ. Linn. Soc.* xiv. (1875) p. 42.

On rotten wood, Amaiama.

Lentinus brevipes, *Cooke in Grevillea* xiv. (1885) p. 12.
On logs, Kumusi River.

Lentinus Sajor-caju, *Fries, Epicr.* (1838) p. 393.
On rotten wood, Kumusi River.

Lentinus crinitus, *Berk. in Ann. Mag. Nat. Hist.* x. (1842) p. 370.

On rotten wood, Lampotan.

Lentinus pergameneus, *Lév. in Ann. Sci. Nat.* sér. 3, v. (1846) p. 117.
On rotten wood, Kumusi River.

Lentinus exilis, *Klotzsch in Fries Syn. Gen. Lent.* (1836) p. 10.
On rotten wood, Guni Guni.

Lentinus crenulatus, *Massee* (*sp. nov.*). *Pileus* membranaceus, coriaceo-lentus, subreniformis, albidus aut cinnamomeus, tomento albo obductus, sæpe floccosus, margine striatus, 4–5 cm. latus. *Lamellæ* confertissimæ, albidæ, ætate stramineæ, acie lacerato-dentatæ. *Sporæ* ellipticæ, hyalinæ, 7 × 4 μ. *Stipes* tenax, fuscus, 1–2 cm. longus, excentricus.
On rotten branches, Samarai.
Allied to *Lentinus flabelliformis*, Fries, but distinguished by the crowded gills and elliptical spores.

Schizophyllum commune, *Fries, Syst. Myc.* i. (1821) p. 330.
On a rotten trunk, Dogura.

Polyporus betulinus, *Fries, Syst. Myc.* i. (1821) p. 358.
On trunks, Samarai.

Polyporus auberianus, *Mont. in La Sagra, Hist. Ile Cuba, Crypt.*, (1838–42) p. 399.
On rotten wood, Medan.

Fomes incrassatus, *Sacc. Syll.* vi. (1888) p. 205.
On logs, Malama River.
This species has been previously collected in New Guinea by Armit.

Fomes senex, *Sacc. Syll.* vi. (1888) p. 164.
On logs, Jimari.

Fomes conchatus, *Gill. Hymén.* (1874) p. 658.
On dead wood, Kumusi River.
The specimens agree exactly with the Australian form of this species, being altogether smaller than the typical European form, but at the same time not differing in any essential features.

Fomes Curreyi, *Sacc. Syll.* vi. (1888) p. 195; *Polyporus xerophyllaceus*, Curr. in Trans. Linn. Soc. ser. 2, i. (1876) p. 124 (non Berk.).
On logs, Jimari.

Polystictus Xanthopus, *Fries in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 74.
On rotten wood, Medan.

Polystictus nephridius, *Sacc. Syll.* vi. (1888) p. 219.
On logs, Kumusi River.

Polystictus affinis, *Fries in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 75.
On fallen trunks, Kumusi River.

Polystictus ochrotinctus, *Sacc. Syll.* vi. (1888) p. 225.
On dead wood, Kumusi River.

Polystictus submembranaceus, *Sacc. Syll.* vi. (1888) p. 288.
On dead branches, Kumusi River.

Polystictus sanguineus, *Fries, in Nov. Act. Soc. Sci. Upsal.* i. (1851) p. 75.
On decayed trunks and stumps, Kumusi River.

Polystictus Persoonii, *Sacc. Syll.* vi. (1888) p. 272.
On decayed trunks, Kumusi River.

A very variable species; sometimes effused and closely adnate without the slightest trace of a free or reflexed margin; such patches vary from 6 inches to 2 feet in length, and judging from the appearance of herbarium specimens, are sometimes still larger when growing. In other specimens, the greater portion of the fungus is resupinate, the margin alone being free and more or less reflexed. Finally, there is every stage of transition shown by this species, from the typical *Poria*, or resupinate form, to the equally typical *Polystictus* form, growing horizontally, and attached to the matrix by a narrow base. The dark red cuticle usually peels off and disappears as the fungus becomes old, commencing at the margin of the pileus, and producing a very characteristic appearance.

Polystictus obliquus, *Massee (sp. nov.)*. *Pileus* tenuis, coriaceus, applanatus, late obovatus, velutinus, dein glabrescens, concentrice sulcatus, pallidus, nitens, dein fulvescens, azonus, 1 cm. latus. *Pori* minutissimi, rotundati. *Sporæ* subglobosæ, flavidæ, 5 μ. *Stipes* lateralis, concolor, interdum basi fuscescens, 4–5 mm. longus crassusque.

On decayed wood, Kumusi River.

Allied to *Polyporus spathulatus*, Berk., but distinguished by the silky or tomentose pileus.

Poria mellea, *Sacc. Syll.* vi. (1888) p. 317.
On rotten wood, Samarai.

Hexagonia tenuis, *Fries, Epicr.* (1838) p. 498.
On dead wood, Mulama.

Trametes lactinea, *Berk. in Grevillea* i. (1872) p. 66.
On dead wood, Wamira.

Dædalea glaberrima, *Berk. et Curt. in Grevillea* i. (1872) p. 67.

On dead wood, Samarai.

Laschia tremellosa, *Fries, Summa Veg. Scand.* (1846) p. 325.
On decayed wood, Samarai.

Cladoderris dendritica, *Fries in Vet. Akad. Handl. Stockh.* (1848) p. 142.

On dead wood, Kumusi River.

Stereum cyathiforme, *Fries, Epicr.* (1836) p. 55.
On dead wood, Kumusi River.

Stereum pergameneum, *Berk. et Curt. in Grevillea* i. (1873) p. 161.

On dead wood, Kumusi River.

The present species has only been recorded previously from the United States and Brazil.

Stereum fasciatum, *Fries, Epicr.* (1838) p. 546.
On rotten logs, Kumusi River.

Stereum versicolor, *Fries, Epicr.* (1838) p. 547.
On dead wood, Amaiama.

Stereum complicatum, *Fries, Epicr.* (1838) p. 548.
On dead branches, Amaiama.

Hymenochæte leonina, *Berk. et Curt. in Journ. Linn. Soc.* x. (1869). p. 334.
On dead wood, Samarai.

Hirneola polytricha, *Fries in Vet. Akad. Handl. Stockh.* (1848) p. 146.
On dead branches, Samarai.

Guepinia spathularia, *Fries, Elenchus* ii. (1828) p. 32.
On dead wood, Samarai.

Ascomycetes.

Xylaria scopiformis, *Sacc. Syll.* i. (1882) p. 340.
On dead wood, Samarai.

Geopyxis elata, *Massee* (*sp. nov.*). *Ascomata* stipitata, cupulata, extus intusque alutacea, rugulosa, glabra, 2 cm. lata. *Stipes* longissimus, cylindraceus, glaber, pallidus, 6–8 cm. longus, 3–4 mm. crassus. *Asci* cylindraceo-pedicellati, octospori, iodo haud tincti, 320–350 × 18–20 μ. *Sporæ* elliptico-fusoideæ, utrinque acuminatæ, hyalinæ, 32–35 × 14–15 μ. *Paraphyses* filiformes.
On the ground, Kumusi River.
Hypothecium and excipulum formed of slender, interwoven hyphæ, which pass into a small-celled parenchymatous cortex. Allied to *Geopyxis alutícolor*, Berk., but distinguished by the much longer stem, larger spores, and by growing on the ground.

Chætomium comatum, *Fries, Syst. Myc.* iii. (1829) p. 253.
On dead stems of grass, Kumusi River.

Western Australia.

Fungi collected by Miss Egerton-Warburton, and communicated by Sir Ferdinand von Mueller, K.C.M.G., F.R.S., F.L.S.

Basidiomycetes.

Lepiota Lavendulæ, *Sacc. Syll.* ix. (1891) p. 9.
On the ground, Gordon River.

Collybia olivaceo-alba, *Sacc. Syll.* ix. (1891) p. 28.
On the ground, Gordon River.

Lentinus dealbatus, *Fries in Lehm. Pl. Preiss.* ii. (1846–47) p. 133.
On dead wood, Gordon River.

Flammula flavida, *Karst. Ryss. Finl. Hattsv.* (1879) p. 406.
On logs, Gordon River.

Flammula sapinea, *Karst. Ryss. Finl. Hattsv.* (1879) p. 410.
On the ground, Gordon River.

Flammula fusa, *Karst. Ryss. Finl. Hattsv.* (1879) p. 405.
On wood, Gordon River.

Polysaccum microcarpum, *Cooke et Mass. in Grevillea* xvi. (1887) p. 28.
On the ground, Gordon River.

Tasmania.

The following collection, remarkably rich in new and interesting hypogeous species, was referred to Kew for determination by Mr. L. Rodway, of Hobart, Tasmania. Coloured figures of the Basidiomycetes were sent with the specimens.

Basidiomycetes.

Clitocybe lilacina, *Massee* (*sp. nov.*). *Pileus* carnosulus, cyathiformis, margine primo involutus, levis, glaber, pallide violaceus, expallescens, 2–4 cm. latus. *Lamellæ* confertæ, latæ, attenuato-decurrentes, lilacinæ. *Sporæ* ellipsoideæ vel obovatæ, hyalinæ, 7–8 × 5 μ; basidia clavata, 40 × 7–8 μ. *Stipes* æqualis, solidus, subfibrillosus, lilacinus, apice albus furfuraceusque, 5–7 cm. longus.

On the ground, near Hobart, *Rodway*, 54.

A remarkably fine species, superficially resembling the amethyst-coloured form of *Clitocybe laccata*, Fries (*Laccaria laccata*, Berk. & Broome) but differing in the smooth, elliptical spores, and the deeply decurrent gills. *Clitocybe porphyrella*, Berk. & Curt., a North American species, also possesses some points in common with the fungus under consideration, but differs distinctly in having adnate gills.

Russula coccinea, *Massee* (*sp. nov.*). *Pileus* carnosulus, e convexo explanatus depressusve, mox siccus, margine exoletus substriatus, læte coccineus, epidermide separabili, 3–5 cm. latus. *Caro* alba, mitis. *Lamellæ* postice attenuato-annexæ, latæ, æquales, raro subfurcatæ, albidæ, ætate omnino aut tantum hinc inde ochraceo-fuscatæ. *Sporæ* sphæroideæ, eximie verruculosæ, hyalinæ, 11–12 μ; basidia clavata, 21–24 × 9–10 μ. *Stipes* spongioso-farctus, dein lacunosa-cavus, basi subincrassatus, subrugulosus, albus, 3–5 cm. longus.

On the ground, Hobart, *Rodway*, 296.

Distinguished from all known species by the following combination of characters. Taste mild; pileus light to dark crimson; gills and stem white. It has some superficial resemblance to *Russula fragilis*, Fries, which, however, differs in its extreme fragility, acrid taste, and forked gills.

Russula purpurea, *Gillet*, *Tab. Analyt.* (1884) p. 47.

On the ground, near Hobart, *Rodway*, 68.

Identical with the species as described by Gillet, from French specimens.

Lactarius subdulcis, *Fries*, *Epicr.* (1838) p. 345.

On the ground, near Hobart, *Rodway*, 34.

Agreeing with the typical European form.

Leptonia Rodwayi, *Massee* (*sp. nov.*). *Pileus* membranaceus, convexo-explanatus, profunde umbilicatus, margine subundulatus, estriatus, obscure cæsio-virens, squamulosus, siccitate pallescens, 2–3 cm. latus. *Lamellæ* adnatæ, postice sinuato-uncinatæ, latæ, subdistantes, pallidæ. *Sporæ* valde irregulares, roseæ, 8–10 × 7 μ. *Stipes* subfistulosus, flexuosus, fibrillosus, viridi-olivaceus vel uteo-virens.

On the ground, near Hobart, *Rodway*, 47.

Solitary. Pileus dark green, rather satiny, minutely squamulose. Allied to *Leptonia lampropoda*, Fries, and *L. serrulata*, Pers., but differing from both in the dark green colour of the pileus and stem.

Nidularia fusispora, *Massee* (*sp. nov.*). *Peridia* gregaria, haud confluentia, alba, tuberculosa, nudo oculo glabra, tenuissima, tandem undique disrupta et evanescentia. *Sporangiola* numerosa, discoidea, muco copioso involuta, flavo-brunnea, 0·5 mm. lata. *Sporæ* ellipsoideæ, utrinque acutæ, hyalinæ, 9–12 × 4–4·5 μ.

On rotten wood, gully off Huon Road, *Rodway*, 345.

A minute species, 1–4 mm. in diameter; peridium very delicate, silvery-white, evanescent. It belongs to the section *Sorosia* of Tulasne, characterized by the presence of filaments mixed with the spores. The four known species are imperfectly described; only in one instance is any mention made of the spores, hence the nearest affinity of the present species is uncertain.

ASCOMYCETES.

Gymnomyces, *Mass. et Rodw.* (*gen. nov.*). *Peridium* haud distinctum vel nullum. *Gleba* carnosa, ad basin fertilis, extus intusque lacunosa, cellulis cavis ubique subæqualibus; septa haud scissilia. *Basidia* plerumque 2-spora. *Sporæ* globosæ, hyalinæ, echinulatæ vel verrucosæ.

Differs from *Gautieria* in the hyaline, globose spores. Some species of *Octaviania*, in which the peridium is very delicate, bear some resemblance to the species included in the present genus, but are distinguished by the well developed, sterile base and the tinted spores.

Gymnomyces pallidus, *Mass. et Rodw.* (*sp. nov.*). *Gleba* globosa, irregularis, initio albida, dein sordida, cellulis majusculis irregularibus sordide albidis; septa tenuia, albida, nec scissilia. *Sporæ* globosæ, 9–10 μ diam., hyalinæ, verruculosæ, sæpe brevissime caudatæ, in quoque basidio binæ, sterigmatibus brevibus suffultæ.

Underground, *Rodway*, 299.

Irregularly spherical, 2–4 cm. in diameter, very fragile, no distinct peridium. Sterile base obsolete, but in one specimen growing into a slender stem emerging from an umbilicus.

Gymnomyces seminudus, *Mass. et Rodw.* (*sp. nov.*). *Gleba* globosa, albida, extus laxe tomentosa, 1·5–2·5 cm. lata, cellulis minutis creberrimis vacuis irregularibus; septa crassiuscula, albida, nec scissilia. *Basidia* subclavata, 2-sterigmatica. *Sporæ* sphæricæ, 11–12 μ diam., creberrime echinatæ, hyalinæ.

Emerging from the ground, *Rodway*, 124.

There is a delicate external downiness or silkiness, which may be considered as a very rudimentary peridium. There is no trace of a sterile base, which, along with the hyaline spores, separates this fungus from those species of *Octaviania* in which the peridium is slight. Distinguished from *G. pallidus*, Mass. & Rodw., by the larger, strongly and densely echinulate spores.

Genabea tasmanica, *Mass. et Rodw.* (*sp. nov.*). *Peridium* subglobosum, tuberculosum, undique anfractuosum, absque basi propria cortice minutissime granulatum vel rugulosum brunneum. *Gleba* pallida, subimmutabilis, sparsim cellulosa, nigro-punctata.

Asci obovati vel oblongi, obtusi, 70–90 × 45–50 μ, 2–4-spori. *Sporæ* varie dispositæ, late ellipsoideæ, utrinque acutæ, leves, inæquilaterales, 30–35 × 16–20 μ, maturæ brunneo-nigræ, subopacæ, nitentes, utraque guttulam mediam crassam includens.

Underground, in sandy soil, *Rodway*, 119.

A very fine and distinct species, 1·5–2·5 cm. in diameter, remarkable for the very large lemon-shaped spores, which are quite smooth, clear brown, and translucent when young, finally becoming blackish-brown and opaque. When quite young the asci are almost globose, then pyriform or obovate, and finally more or less oblong with age, the arrangement of the spores varying with the form of the ascus. Wall of ascus thick except at one point at the apex; it does not turn blue with iodine. Substance of the gleba consisting entirely of hyaline, sparsely septate, thin-walled, intricately interwoven hyphæ. Not closely allied to any described species.

Hymenogaster Rodwayi, *Massee (sp. nov.)*. *Peridium* globoso-difforme, sat irregulare, carnosulum, sericeum, albidum, demum lutescens. *Gleba* firma, compacta, demum obscure brunnea, cellulis minutis irregularibus e basi sterili ad peripheriam obscure directis. *Basidia* clavata, 2-sterigmatica, sterigmatibus brevibus 40 × 7–8 μ. *Sporæ* ellipticæ vel limoniformes, apice apiculatæ, basi subtruncatæ, longitudinaliter rugulosæ vel carinatæ, initio ochraceæ, dein flavo-brunneæ, 20 × 10–12 μ.

Among buried twigs, Hobart, *Rodway*, 116.

Growing underground, irregular, 2–3 cm. in diameter, white, becoming dingy yellow when dry. Peridium very distinct. Gleba compact, cavities small, irregular in form, showing an indistinct tendency to radiate from the sterile base towards the periphery of the fungus. Sterile base conspicuous, and giving off branching veins penetrating the gleba, which becomes dark brown at maturity. Basidia usually with two sterigmata, sometimes however only a single sterigma is present. Spores elliptical or lemon-shaped, apex apiculate, base slightly truncate at the point corresponding to the attachment of the sterigma; longitudinally ribbed, ribs simple, or forked and anastomosing, strong, converging at the ends.

Most nearly approaching *H. decorus*, Tul.; the latter however differs in the violet tinge of the gleba, the narrow basidia, very inconspicuous sterile base, and larger spores, which lack the strong longitudinal ribs ornamenting the epispore of the present species.

Hymenogaster albellus, *Mass. et Rodw. (sp. nov.)*. *Peridium* globosum, irregulare, subglabrum, album, demum pallidum, tenuissimum, nec separabile. *Gleba* pallide brunnea, firmula, cellulis majusculis e pulvinulo basilari sterili minuto albido subradiantibus. *Basidia* clavata, haud raro furcata vel irregularia, 1–4-, plerumque 2-, sterigmatica, sterigmatibus longiusculis. *Sporæ* elliptico-fusiformes vel citriformes, vulgo utrinque apiculatæ, flavæ, maturitate flavo-brunneæ, verruculosæ 16–17 × 8–9 μ.

Subterranean, *Rodway*, 117.

Irregularly subglobose, white, 2–3 cm. in diameter. Most closely allied to *H. tener*, Berk., but readily distinguished by the larger cavities of the gleba, much less conspicuous sterile base, and the

distinctly although very minutely warted spores. *H. Klotzschii*, Tul., also presents affinities with the present species, but differs in the obtuse, glabrous spores.

Hymenogaster violaceus, *Mass. et Rodw.* (*sp. nov.*). *Peridium* globosum, sat irregulare, lilacino-fuscum, dein violaceum, viscidum, tenue, in gleba innatum, sericeum. *Gleba* subelastica, initio tota albida, dein brunnea, cellulis tortuosis majusculis creberrimis basi sterili glebæ minutis; septa tenuia. *Basidia* angusta, subflexuosa, 2-sterigmatica, sterigmatibus longiusculis acutis. *Sporæ* globoso-ellipticæ, obtusæ, verruculosæ, 9 × 7 μ, initio ochraceæ, dein fuscæ.

Subterranean, or emerging from the ground, *Rodway*, 297.

Irregularly subglobose, 2–3 cm. in diameter. Allied to *Hymenogaster lilacinus*, Tul., and *H. decorus*, Tul.; differing from the former in the viscid, violet peridium and warted spores; and from the latter in the absence of a violet or purple tinge in the gleba, and the much smaller spores.

Hysterangium viscidum, *Mass. et Rodw.* (*sp. nov.*). *Peridium* irregulare, oblongum, extus castaneum, viscidum, 3 × 1·5 cm., facile a gleba separabile, elasticum, cellulis e basi radiantibus irregularibus minutis; septa crassa, brunnea, non scissilia. *Sporæ* oblongo-ellipticæ, utrinque obtusatæ, 14–15 × 10 μ, 3–4 in quoque basidio, papillatæ, flavo-brunneæ, pellucidæ, vel in massis visæ sordide brunneæ.

Underground, near Hobart, *Rodway*, 270.

Readily distinguished in the genus by the chocolate-brown, viscid peridium, and the elliptic-oblong, obtuse spores.

Hysterangium fusisporum, *Mass. et Rodw.* (*sp. nov.*). *Peridium* subglobosum, irregulare, leve, albidum, tenuissimum, nec a gleba separabile, extus albidum flavo-maculatum, intus albidum. *Gleba* firma, pallida, cellulis exiguis irregularibus sinuosis absque basi sterili vix conspicuis. *Sporæ* fusiformes, leves, 20–22 × 8 μ, in quoque basidio binæ, sterigmatibus brevibus suffultæ, hyalinæ.

Growing underground, *Rodway*, 276.

A distinct species, irregularly subglobose, 1·5–2 cm. in diameter. Allied to *H. membranaceum*, Vittad., and to the following species, but readily distinguished from either by the larger, distinctly fusiform, hyaline spores, acute at both ends.

Hysterangium affine, *Mass et Rodw.* (*sp. nov.*). *Peridium* subglobosum, basi fibrillis radicalibus instructum, supra nudum, crassum, extus pallide fuscum, fibrillosum, intus candidum, a gleba facile secedens. *Gleba* matura gelatinoso-elastica, prima ætate sordide viridis, dein obscure grisea, cellulis difformibus gyrosis creberrimis minutis. *Basidia* oblongo-subclavata, 40 × 8 μ, plerumque tetraspora, sterigmatibus brevibus. *Sporæ* ellipsoideo-oblongæ, utrinque obtusatæ, leves, pallide glauco-virescentes, 11–13 × 5–6 μ.

McRobie's Gully, Hobart, *Rodway*, 123.

A very fine species, subglobose, 1–2 cm. in diameter, collected in abundance at the locality given above, by Mr. Rodway. Occupying a position intermediate between *H. clathroides*, Vittad., and *H. membranaceum*, Vittad., but quite distinct from either. Distinguished from the first named in the presence of well developed, persistent

rooting fibres, and the absence of a broadly effused, pure white mycelium; and from *H. membranaceum*, Vittad., in the thick. glabrous peridium, and the very slight indication of a sterile base,

The basidia are most frequently tetrasporous, but a few bisporous basidia are present. The sterigmata are very short.

Hysterangium clathroides, *Vittad. Monog. Tuber.* (1831) p. 13, t. 4, fig. 2.

Subterranean, *Rodway*, 265.

Hysterangium membranaceum, *Vittad. Monog. Tuber.* (1831) p. 14, t. 4, fig. 15.

Closely allied to *H. affine*, Mass. & Rodw., but distinguished by the membranaceous, dry, subtomentose, white peridium, which, like the gleba, becomes tinged with indigo or green when bruised.

Underground, Hobart, *Rodway*, 288.

Hydnangium australiense, *Berk. et Broome in Trans. Linn. Soc.* ser. 2, ii. (1883) p. 64; *Octaviania australiensis*, Cooke, Handb. Austr. Fung. (1892) p. 246.

Subterranean, *Rodway*, 20. Also known from Victoria.

Emerging from the ground; when freshly cut milk-bearing. Irregularly reniform, 1·5–2 cm. in diameter, rufous-brown. Gleba rather compact, paler; sterile base small or none, peridium distinct, continuous. Spores hyaline, globose, very minutely and sparsely verruculose, 10–13 μ in diameter. Basidia clavate, bisporous or rarely monosporous, sterigmata elongated.

The Tasmanian specimens agree perfectly with Berkeley's type of the species.

Hydnangium carneum, *Wallr. in Dietr. Fl. Boruss.* (1838) t. 465.

Underground, *Rodway*, 118. Widely distributed: there are specimens in the Kew Herbarium from the following countries: England, Scotland, France, Germany, Silesia, Italy, Sweden, Finland, and Australia.

Irregular, 2–3 cm. in diameter, smooth, pale pink. Peridium very thin. Gleba rather friable, pink; cavities tortuous, rather large; sterile base very distinct, sometimes sending strands through the gleba. Basidia narrowly cylindric-clavate, with two long, tapering sterigmata, rarely only one sterigma is present. Spores globose, hispid with crowded, slender spines, 2–3 μ long, hyaline, 13–18 μ in diameter.

Allied to *H. australiense*, Berk. & Broome, but readily distinguished by the pink tinge of the peridium and gleba, and the more distinctly spinulose spores.

Hydnocystis cyclospora, *Massee; Berggrenia aurantiaca*, var. *cyclospora*, Cooke, in Grevillea xv. (1886) p. 16; *Hydnocystis convoluta*, McAlpine, in Agric. Gaz. N. S. Wales vii. (1896) p. 86.

Rodway; and also New Zealand, *Colenso*.

Cooke states that the spores of var. *cyclospora* measure 18 μ in diameter but an examination of the type specimen proves that the spores range from 9–12 μ in diameter.

Meliola amphitricha, *Mont. in La Sagra, Hist. Ile Cuba, Crypt.*, (1838–42) p. 326.

On a dead leaf of *Olearia argophylla*, F. Muell., *Rodway*, 472.

Meliola corallina, *Mont. in Gay, Fl. Chil.* vii. (1850) p. 472.
On living leaves of *Cyathodes glauca*, Labill., and *Pomaderris apetala*, Labill., *Rodway*, 366, 421.

Xylaria digitata, *Grev. Flor. Edin.* (1824) p. 355.
On the ground on sandy heaths, Hobart, *Rodway*.

A peculiar form of this variable species, with a long, rooting, stem-like base pushing deep down into the loose sand, and bearing a rosette of short, obtuse, finger-like, equal branches at the apex.

Nummularia Bulliardi, *Tul. Sel. Fung. Carp.* ii. (1863) p. 43, t. 5, figs. 11–19.

On dead bark of *Acacia dealbata*, Link, *Rodway*, 465.

Hypoxylon annulatum, *Mont. in Gay, Fl. Chil.* vii. (1850) p. 445.

On dead wood of *Fagus Cunninghami*, Hook., Hobart, *Rodway*, 184.

Very fine specimens of this somewhat variable species. The depression round the ostiolum is very pronounced.

Hypoxylon cœlatum, *Cesati, Myc. Born.* (1879) p. 19.
On dead *Eucalyptus* wood, *Rodway*, 310, 453.

Agrees exactly with specimens collected by Beccari in Borneo.

Hypoxylon serpens, *Fries, Summa Veg. Scand.* (1846) p. 384.
On dead *Eucalyptus* wood, *Rodway*, 181.

Hypoxylon multiforme, *Fries, Summa Veg. Scand.* (1846) p. 384.
On dead bark of *Acacia dealbata*, Link, *Rodway*, 454.

Hypoxylon Archeri, *Berk. in Hook. f. Fl. Tasm.* ii. (1860) p. 280.
On dead *Eucalyptus* wood, *Rodway*, 451.

Agrees exactly with Berkeley's type specimen. There is a minute, smooth, depressed ring or zone round the very small, papillate ostiolum, as in *Hypoxylon annulatum*, Mont., but in *H. Archeri*, the perithecia are much smaller, as is also the ring round the ostiolum.

Eutypa lata, *Tul. Sel. Fung. Carp.* ii. (1863) p. 56.
On dead *Eucalyptus* bark, *Rodway*, 466.

Dimerosporium tasmanicum, *Massee* (*sp. nov.*). *Perithecia* gregaria, mycelio maculiformi atro erumpentia, sphæroidea, astoma, setosa, fusca atrave, 80–100 μ lata. *Asci* cylindraceo-clavati, breviter pedicellati, octospori, 80–90 × 15–18 μ. *Sporæ* distichæ, oblongo-ellipticæ, medio 1-septatæ, utrinque rotundatæ, 18–20 × 8–9 μ, dilute olivaceo-fuscæ. *Paraphyses* filiformes, ramosæ.

On one surface only of the phyllodes of *Phyllocladus rhomboidalis*, Rich., *Rodway*, 367.

The perithecia have short, black, spine-like hairs scattered sparingly over the entire surface. Subiculum at times dense and more or less covering the entire surface of the leaf, at others almost or entirely absent. Perithecia in groups of 3–6 usually surrounding a central one. Allied to *D. excelsum*, Cooke, from New Zealand, but differing in the larger spores and pilose perithecia.

Rosellinia mammoidea, *Sacc. Syll.* i. (1882) p. 263; *Psilosphæria mammoidea*, Cooke in Grevillea viii. (1879) p. 67.

On dead wood of *Eucalyptus*, *Rodway*, 271. The type was collected in New Zealand.

A very fine species. The perithecia are sometimes so closely crowded as to become somewhat irregular from lateral pressure, and to suggest an affinity with the genus *Hypoxylon*. The perithecia are just a little more depressed round the papillate ostiolum than in the typical form, otherwise there is no difference.

Gibbera fulvella, *Massee* (*sp. nov.*). *Stroma* pulvinatum, suberumpens, 1–2 mm. latum. *Perithecia* tuberculato-prominula, fulvo-miniata, dein brunneo-atra, glabra, ostiolo vix visibile. *Asci* oblongo-ovati, 35–40 × 8–10 μ. *Sporæ* distichæ, ellipticæ, hyalinæ, medio 1-septatæ, utrinque subacutæ, 18–20 × 4–4·5 μ.

On living leaves of *Dillwynia cinerascens*, R. Br., *Rodway*, 355.

Elliptic-oblong, pale brown, 1-septate conidia, measuring 18–21 × 4–5 μ, are sometimes present in considerable numbers on the stroma. The leaves of the host are stunted by the fungus.

Quaternaria aspera, *Massee* (*sp. nov.*). *Stroma* suberumpens, corticolum, effusum, scabrosum. *Perithecia* subglobosa, ostiolo prominula, subcutaneo-erumpentia. *Asci* cylindraceo-clavati, longissime stipitati, 180 × 8 μ, octospori. *Sporæ* distichæ, cylindraceo-curvatæ, utrinque obtusatæ, pallide fusco-olivaceæ, 10–12 × 3–3·5 μ.

On the bark of *Pomaderris apetala*, Labill., *Rodway*, 488.

Only a small specimen was sent, and this did not show the margin of the fungus, which appears to form broadly-effused, scabrid patches on the branches.

Byssosphæria Aquila, *Cooke, Handb. Austr. Fung.* (1892) p. 304, t. 24, fig. 219.

On decaying *Eucalyptus* wood, *Rodway*, 452.

The dense subiculum has a purple tinge, but in all important features the fungus is indistinguishable from European specimens.

Zignoella Archeri, *Sacc. Syll.* ii. (1883) p. 217.
On rotten wood, *Rodway*, 499.

Hypomyces fulgens, *Karst. Myc. Fenn.* ii. (1873) p. 207.
On rotting wood, *Rodway*, 493.

The perithecia vary from very pale yellow to orange, the ostiola usually darker in colour; otherwise as in Karsten's specimens.

Hypocrea nebulosa, *Massee* (*sp. nov.*). *Stroma* effusum, tomentosum, lutescens, ostiolis peritheciorum crebre punctatum. *Perithecia* minuta, subglobosa. *Asci* cylindracei, 60–70 × 8 μ. *Sporæ* octonæ, biloculares, hyalinæ, 10 × 6 μ, loculis mox secedentibus.

On a dead *Polyporus*, *Rodway*, 484.

A very distinct and remarkable species, in some respects intermediate between the genera *Hypomyces* and *Hypocrea*. Agreeing with the former in the somewhat byssoid and mealy, thin subiculum in which the numerous perithecia are completely immersed, but conforming with *Hypocrea* in the narrowly cylindrical asci containing eight spores, each of which divides into two portions at an early stage of development, thus presenting the appearance

of an ascus containing sixteen spores. The present species agrees most closely with *Hypocrea citrina*, Fries, but differs in the thinner, byssoid stroma and shorter asci. *Hypocrea fungicola*, Karst., which also occurs on old specimens of *Polyporus* and other fungi, differs in the thicker, waxy, yellow stroma.

Mitrula cucullata, *Fries*, *Epicr.* (1838) p. 584.
On small twigs of *Eucalyptus urnigera*, Hook. f., *Rodway*, 433.

The occurrence of the perfectly typical form of this fungus growing on *Eucalyptus* twigs is interesting, as hitherto it has only been met with on dead leaves of conifers. This circumstance serves to corroborate what has been previously stated respecting the value of the host as a specific factor, and may serve to modify the views of those who, on the ground that they depend on particular species of conifers, have attempted to discriminate between the European species of *Mitrula*.

Peziza vesiculosa, *Bull. Champ. Fr.* (1791) p. 270, t. 457, fig. 1. Forma glabrata. *Ascoma* extus pallide brunneum vix granulosum. *Hymenium* obscure brunneum.

On rich ground, manure, etc., *Rodway*, 23.

Differing from the typical form in the dark brown disc, and paler, almost even and glabrous exterior. This form has also been received from Victoria (*Mrs. Martin*).

Patellaria Maura, *Massee* (*sp. nov.*). *Ascomata* gregaria, sessilia, concaviūscula, dein planiuscula, virenti-atra, sicca tota nigra, 1–2 cm. lata. *Asci* clavati, basi parum constricti, octospori, iodo operculo cœruleo-tincti, 150 × 10 μ. *Sporæ* distichæ, ellipsoideo-oblongatæ, 3–6-, plerumque 5-, septatæ, hyalinæ, 18–22 × 5 μ. *Paraphyses* filiformes, ramosæ, apice subincrassatæ, 2 mm. latæ.

On dead branches of *Acacia verniciflua*, A. Cunn., Hobart, *Rodway*, 467.

Allied to *P. tasmanica*, Berk., but distinguished by the larger size of the ascophore, also by the longer, septate spores. The hypothecium and excipulum consist of slender interwoven hyphæ.

Aleurina tasmanica, *Massee* (*sp. nov.*). *Ascomata* gregaria, carnosā, subsessilia vel subradicato-producta, ex hemisphærico expansa, extus saturate brunnea, verrucosa, 2–3 cm. lata, hymenio flavo-brunneo depallente. *Asci* cylindraceo-pedicellati, iodo haud tincti, 300–325 × 18–20 μ. *Sporæ* late ellipticæ, utrinque obtusatæ, episporio verruculosæ, flavo-brunneæ, 26–30 × 13–15 μ. *Paraphyses* septatæ, apice clavato, succineo-farctæ, 4–5 mm. crassæ.

On the ground, Hobart, *Rodway*, 128.

Distinguished from all described species by the warted exterior of the ascophore, and the large spores with a somewhat coarsely warted epispore.

SPHÆROPSIDEÆ.

Libertella aurantiaca, *Massee* (*sp. nov.*). *Acervuli* flavidi, difformes, diu epidermide velati, tandem in cirrhos tortuosos auranticolores erumpentes. *Conidia* filiformi-falcata, continua, hyalina, 5–7 × 1·5 μ.

On dead *Eucalyptus* wood, *Rodway*, 504.

The masses of spores are buried in the substance of the wood or bark, and ooze out in bright orange, variously contorted, gelatinous tendrils, which become rigid and brittle when dry. Indistinguishable from *Libertella faginea*, Desm., to the naked eye, but readily distinguished under the microscope by the much smaller, almost or sometimes quite straight spores.

Stagonospora chalybea, *Massee* (*sp. nov.*). *Perithecia* dense gregaria, suberumpentia, subrotunda, levia, astoma, nigra, circiter 0·5 mm. diam., contexta distincte parenchymatica chalybeo-purpurea. *Basidia* filiformia. *Sporulæ* oblongo-cylindraceæ, utrinque subattenuatæ, 24–28 × 7–9 μ, rectæ curvulæve, 1–3-septatæ.

On dead bark of *Eucalyptus*, *Rodway*, 440.

Distinguished by the large, aggregated perithecia, large celled parenchyma of a clear, intense blue or purplish-blue colour, and the large 3-septate spores. May possibly prove to be the pycnidial condition of an ascigerous fungus belonging to the genus *Gibberella*.

MYXOGASTRES.

Trichia fragilis, *Rostaf. Monog. Myc.* (1875) p. 246.
On dead bark, *Rodway*, 452.

NEW ZEALAND.

Specimens communicated by the Rev. William Colenso, F.R.S., Napier, New Zealand.

BASIDIOMYCETES.

Marasmius tinctorius, *Massee* (*sp. nov.*). *Pileus* coriaceo-membranaceus, conico-convexus, demum explanatus, late umbonatus, glaber, levis, croceo-fuscus, margine primitus incurvo, 0·5–1 cm. latus. *Lamellæ* in juventute sat confertæ, tandem subdistantes, initio albæ, dein flavæ, utrinque rotundatæ. *Sporæ* ellipsoideæ, albo-flavidæ, 5 × 3 μ. *Stipes* æqualis, levis vel subtiliter striatus, strictus, 1–1·5 cm. longus, 2 mm. crassus, pileo concolor.

Gregarious, on a rotten log, *Colenso*, 1489.

Every part of the plant has a yellow tinge, and when soaked in water or spirit, gives out a yellow colouring matter. Allied in some respects to *M. ferrugineus*, Berk., but differing in the even pileus and crowded gills.

Hypholoma glutinosum, *Massee* (*sp. nov.*). *Pileus* carnosus, convexo-planus, discoideus, sæpe subgibbosus, albo-luteus, disco castaneus, squamis maculiformibus appressis concoloribus, præcipue in juventute eleganter variegatus, ætate glabrescens, viscidus, 4–9 cm. latus. *Lamellæ* adnatæ, confertæ, flavo-viridescentes, acie subcrenulatæ. *Sporæ* oblongo-ellipticæ, utrinque obtusæ, viridi-fuscæ, 7–8 × 4–5 μ. *Stipes* farctus, dein cavus, fibrillosus, carne flavus.

In clusters on logs, Dannevirke, *Colenso*, 1507.

A fine species, much resembling *H. sublateritium*, Sacc., in general appearance, but distinguished by the viscid or glutinous pileus, which is ornamented, especially when young, with tawny, floccose scales. If the gluten is washed off with rain the pileus is naked and glabrous at maturity, but if the viscidity dries on the pileus the scales are also glued down and persist. The taste is slightly acrid when dry.

ASCOMYCETES.

Parodiella maculata, *Massee* (*sp. nov.*). *Perithecia* dense gregaria, in maculis elongatis nigricantibus nidulantia, atra, 100–125 μ diam. *Asci* oblongo-clavati, breviter pedicellati, octospori, 50 × 14 μ. *Sporæ* distinctæ, 1-septatæ, sub-hyalinæ, elongato-ellipticæ, utrinque acutæ, 20 × 5–6 μ. *Paraphyses* filiformes.

On the leaf of an undetermined plant, *Colenso*, 1496.

A typical *Parodiella* in every respect save the subhyaline spores, and in this one feature is distinct from all known species.

NUBIA.

Collected and communicated by the late Mr. J. Theodore Bent, F.R.G.S.

USTILAGINEÆ.

Ustilago Digitariæ, *Rabenh. Fung. Eur.* no. 1199.
Parasitic on *Panicum Teneriffæ*, R. Br., distorting the ovary.

BERMUDA.

Specimens communicated by Surg.-Capt. H. A. Cummins, F.L.S.

PHYCOMYCETES.

Peronospora Lamii, *De Bary in Rabenh. Herb. Myc.* ed. 2, no. 325.

ST. GEORGE'S. On living leaves of *Lamium amplexicaule*, Linn.

SPHÆROPSIDEÆ.

Epiclinium Cumminsii, *Massee* (*sp. nov.*). *Sporodochia* atra, dense aggregata, erumpenti-superficialia, convexo-pulvinata, circa 0·5 mm. diam., compacta. *Conidia* crebra, obpyriformi-clavata, 18–21 × 10 μ, 1-septata, ad septum subconstricta, olivaceo-nigra, sporophoris brevibus teretibus concoloribus suffulta.

ST. GEORGE'S. On living leaves of *Carica Papaya*, Linn.

UREDINEÆ.

Uromyces striatus, *Schröt. in Abh. Schles. Ges.* (1869) p. 11, ex *Sacc. Syll.* vii. (1888) p. 542.

ST. GEORGE'S. On living leaves of *Medicago denticulata*, Willd.

Graphiola Phoenicis, *Poit. in Ann. Sci. Nat.* sér. 1, iii. (1824) p. 473.

ST. GEORGE'S. On living leaves of *Sabal blackburnianum*, Glazebr.

TRINIDAD.

The following fungi were collected and communicated by Mr. John H. Hart, F.L.S., Superintendent of the Royal Botanic Gardens, Trinidad.

ASCOMYCETES.

Eutypa erumpens, *Massee* (*sp. nov.*). *Stroma* latissime effusum, maculiforme, innatum, dein subsuperficiale, in ramis corticatum, scabrum, extus intusque nigrum. *Perithecia* densissime stipata, ovoidea, mutua pressione sæpe compressa, majuscula, 0·5–0·8 mm. lata, ostiolo papillato. *Asci* cylindraceo-clavati, longissime stipitati, 175–200 × 7–8 μ, octospori. *Sporidia* disticha, cylindracea, utrinque subacuta, subreniformia, dilute olivacea, 16–18 × 5–6 μ.

Parasitic on *Ficus indica*, Linn.

The fungus forms black, irregularly shaped patches 10–40 cm. broad, which burst through the bark here and there, giving the trunk a spotted appearance. The present species covered the lower portion of the trunk of a large specimen of *Ficus indica*, well known as a landmark in Trinidad. Resembling *E. lata*, Tul., and *E. leioplaca*, Cooke, in habit, but distinguished by the much larger spores.

Daldinia aspera, *Massee* (*sp. nov.*). *Stroma* subglobosum, basi applanatum, atrum, opacum, corrugatum, intus brunneum, concentrice zonatum, 5–10 cm. latum. *Perithecia* ovata, peripherico-immersa, exigua. Asci cylindracei, longissime pedicellati, 185–220 × 7–8 μ. *Sporæ* oblique monostichæ, oblongæ, fuscæ, 17–20 × 6–7 μ. *Paraphyses* filiformes.

Growing on rotten wood, *Hart*, 6173.

Distinguished at once from every other species by the somewhat coarsely corrugated exterior, which is not due to shrinkage during drying, but is a normal and constant character. Interior solid, brownish or umber, concentrically zoned.

Lachnea erinaceus, *Sacc. Syll.* viii. (1889) p. 182.
On rotten wood, *Hart*, 5122.

UREDINEÆ.

Uredo Orchidis, *Winter in Rabenh. Krypt. Fl.* i. (1884) p. 256.
On leaves of an orchid, *Hart*, 5120.

Uredo Vitis, *Thümen, Pilze des Weinstockes* (1878) p. 182; *U. Vialæ*, Lagerheim in Compt. Rend. cx. (1890) p. 728.

On leaves of cultivated vines.

The present species appears to be not uncommon on the foliage of cultivated vines in the West Indies. The species afterwards described by Lagerheim from West Indian specimens, is identical in every respect with Thümen's species. For detailed account concerning this point, see *Grevillea* xxi. (1893) p. 119.

Uredo Cannæ, *Winter in Hedwigia* xxiii. (1884) p. 172. Destroying the foliage of "Madame Crozy" *Canna*, in the Botanic Garden, *Hart*, 6171.

The cause of a serious disease to Cannas in the New World, but apparently has not yet been observed in Europe. In Winter's diagnosis of the species he describes the spores as colourless, with a query. When fresh the contents of the spores are clear yellow, and the epispore is very minutely echinulate.

HYPHOMYCETES.

Brachysporium corynoideum, *Sacc. Syll.* iv. (1886) p. 423. On decaying herbaceous stems, *Hart*, 5119.

Botrytis tenella, *Sacc. Syll.* iv. (1886) p. 119. Parasitic on a "thorny" spider.

The entire body of the spider is covered with a dense, snow-white mycelium.

MYXOGASTRES.

Arcyria leiocarpoides, *Massee, Monog. Myx.* (1892) p. 167. On decayed wood and moss, *Hart*, 5121.

BRITISH GUIANA.

The following fungi were collected, and sent to Kew for determination, by Mr. George S. Jenman, F.L.S., Superintendent of the Botanic Gardens, George Town, British Guiana.

BASIDIOMYCETES.

Polystictus sanguineus, *Fries in Nov. Act. Soc. Sci. Upsal.* i, (1851) p. 75.

Demerara, *Jenman*, 7032.

The Agaricineæ are divided into five primary sections, Melanosporæ, Porphyrosporæ, Ochrosporæ, Rhodosporæ, and Leucosporæ, depending on the colour of the spores as seen in the mass. The discovery of fungi having green spores necessitates the formation of an additional section, which will naturally stand as Chlorosporæ. This section occupies an intermediate position between the Leucosporæ and the Rhodosporæ.

Sect. CHLOROSPORÆ. Sporæ ellipticæ, chlorinæ.

Chlorophyllum, *Massee* (*gen. nov.*). *Hymenophorum* a stipite discretum, velo universali cum epidermide pilei concreto. *Stipes* annulatus, sed volva destitutus. *Lamellæ* liberæ, membranaceæ, persistentes, albæ, dein chlorinæ. *Sporæ* ellipsoideæ, chlorinæ.

Analogous with the genus *Lepiota* in the Leucosporæ, but distinguished by the green gills and spores.

Chlorophyllum esculentum, *Massee* (*sp. nov.*). *Pileus* carnosus, convexō-expansus, subumbonatus, cute in squamas (majores centrum versus, ad marginem minores quandoque deficientes) secedentes laceratus, 15–20 cm. latus; caro a stipite discreta, 1–1·5 cm. crassa. *Lamellæ* confertæ, angustæ, albæ, dein virides, a stipite distantes. *Stipes* 18–25 cm. altus, cylindraceus, basi subbulbosus, levis, subcavus, annulo mobili apicali persistente. *Sporæ* ovatæ, utrinque obtusatæ, leves, 7–8 × 5 μ, coacervatæ olivaceo-virentes.

Coast-land pastures, *Jenman*, 6166.

Edible mushroom, all white, gills turning livid green on the second day, 6–8 inches in diameter (Jenman).

Allied to the North American species *C. Morgani*, Massee, (Agaricus Morgani, *Peck.*) but distinguished by the white pileus and smaller spores. The only other species known, *C. Molybdites*, Massee, is a native of Brazil.

Schulzeria Eyrei, Massee, (in *Grevillea* xxii. (1894) p. 38, t. 185, fig. 1.) belongs to this group and forms a second genus, for which the name *Chlorospora* is proposed. It is characterised as follows: *Hymenophorum* a stipite discretum, velo universali cum epidermide pilei concreto. *Stipes* volva et annulo carens. *Lamellæ* liberæ. *Sporæ* ellipsoideæ, chlorinæ.

Distinguished from *Chlorophyllum* by the absence of a permanent ring on the stem. The only species is *C. Eyrei*, Massee, a native of the New Forest.

DCX.—MISCELLANEOUS NOTES.

MR. HAROLD BUCHAN LLOYD, a member of the gardening staff of the Royal Gardens, and formerly in the employ of the Earl of Sefton at Croxteth Park, Liverpool, has been appointed, on the recommendation of Kew, by the Secretary of State for Foreign Affairs, Assistant Curator of the Botanic Gardens at Old Calabar, in the Niger Protectorate, in succession to Mr. J. H. Holland, promoted to the post of Curator. Mr. Lloyd left Kew in May.

MR. HARRY HOLLEY, a member of the gardening staff at Kew, has been appointed Assistant in the Municipal Gardens at Cape Town. He left for South Africa in May.

Botanical Magazine for May.—The plates of four of the plants described could not be issued till this month, owing to a fire at the lithographers. *Amomum hemisphæricum*, the plate of which has appeared, is quite new to cultivation. It is a native of Java, and roots were sent to Kew by H. N. Ridley, Esq., M.A., Director of the Gardens and Forest Department, Straits Settlements.

Stephanandra Tanakae, native of Japan, is a slender shrub, with terminal, pendulous panicles of small, white flowers. Seeds were received from the Botanical Garden of the Imperial University of Tokio in 1893. The genus is closely allied to *Neillia*, from which it differs in having a monocarpellary ovary. *Symphyandra Wanneri*, from the Banat, has been in cultivation in the Royal Gardens for many years, where it flowers outside, in June. *Symphyandra* is distinguished from *Campanula* by having the anthers united in a tube. *Kalanchoe flammea* was first described in the *Kew Bulletin*, 1897, p. 266. The plant figured was raised from seeds collected by Mrs. Lort Phillips and Miss Edith Cole in Somaliland. Its attractive flowers last two months. *Armeria caespitosa*, a high mountain plant of Spain and Portugal, was raised from seeds received from the Botanical Gardens of Madrid in 1893, and flowered at Kew in April, 1897. The species is allied to *A. maritima*, but it is a much smaller plant, sometimes, when in flower, not exceeding an inch and a half in height.

Hooker's Icones Plantarum.—The third part of the sixth volume of the fourth series appeared in April, but in consequence of a fire at the lithographers it was issued without the full number of plates. In this part the genus *Loeselia* is illustrated by two plates including a new species, *L. cordifolia*; and there is a revision of the synonymy of *L. involucrata* and *L. ciliata*. *Passiflora fuchsiiflora*, a native of British Guiana, is remarkable for the character which suggested the specific name. *Rhigiophyllum squarrosum* is a very singular member of the Campanulaceæ, native of South Africa, first discovered upwards of fifty years ago, and re-discovered by Mr. Schlechter and Mr. Harry Bolus in 1896. Previous to the arrival of Mr. Bolus's specimens the plant was unrepresented in the herbaria of this country. *Poupartia Fordii* (Anacardiaceæ) is a small tree, inhabiting Hong Kong, imperfectly known until Mr. Ford, Superintendent of the Botanic Garden there, sent complete specimens. *Pittosporum spathaceum* is a Tonga Island species characterised by having a spathaceous calyx. *Microula tibetica* (Boraginaceæ) is interesting on account of the variability exhibited by its nutlets, a circumstance which has given rise to more than one genus being proposed for the same species. *Phyllanthodendron mirabilis* is a split off from *Phyllanthus*, presenting some curious structural and vegetative characters. *Pachylobus edulis* (Burseraceæ), from tropical Africa, has a most singular embryo with very thick, pinnate cotyledons. In other respects it is closely allied to *Canarium*, except that the endocarp is thin. The principal feature of this number, however, is an attempt to illustrate, and elucidate the synonymy, of the species of *Hevea*. Six plates are devoted to this purpose, four of which were destroyed by fire; but they are being reproduced and will be issued, together with others of the same genus, with the next number. It is hoped that they will be of some practical use; and it is intended to illustrate other rubber-yielding plants.

Rosa gigantea.—A flowering specimen of this species has been received at Kew from T. H. Hanbury, Esq., La Mortola, Ventimiglia, Italy, with the following information under date of April 26.—On Sunday I saw *Rosa gigantea* in full bloom on the façade of the Chateau Eleonore at Cannes, the residence of Lord Brougham and Vaux. The plant is growing in a box measuring, perhaps, $2\frac{1}{2}$ ft. × 1 ft. × 1 ft., and I should say that this box must be entirely full of the roots of the plant. The colour of the buds reminded me of those of the rose, Wm. Allen Richardson, but under the strong sun it opens very quickly and looks almost white before the petals fall.

R. gigantea was discovered in Burma, on the Shan hills plateau, at 4,000 to 5,000 feet. by Sir Henry Collett, K.C.B., and also in Manipur, at an altitude of 6,000 feet, by Dr. Watt.

At first there seemed hopes that this fine climber would succeed on walls, &c., in sheltered places in Britain, but although several plants at Kew and elsewhere withstood—with comparatively little protection—the severe winter of 1890–1, that of 1892–3 killed all of them outright. At Kew it grows vigorously under glass, but, so far, has not flowered.

Totem Pole from British Columbia.—By the courtesy of the Provincial Government of British Columbia the Timber Museum (No. III) of the Royal Gardens has been enriched by a very interesting specimen of the decorative door posts or "Totem" poles used by the Indians on the Pacific coast. These posts are usually made of Red Cedar (*Thuja gigantea*) and are elaborately carved with figures of men and animals, and coloured. There is an account, with illustrations, by Dr. Boas, in the Report of the British Association for the Advancement of Science for the year 1890 (pp. 564, 565). These posts possess considerable interest from an ethnographical point of view, and are likely to become very scarce or disappear altogether as the Indians adopt European habits. They also exhibit one of the numerous uses to which the Red Cedar of the Pacific slopes is applied.

Some of the poles are 30 to 50 feet high and give a singularly picturesque appearance to the Indian villages. The specimen presented to Kew is the lower part of a pole originally 35 feet high. It is now about 16 feet high and 3 feet 9 inches broad; it is hollowed out at the back and rounded in front. In the lower part there is an aperture about $5\frac{1}{2}$ feet, by 2 feet, which formed the doorway into the dwelling. The front part is deeply carved into allegorical figures of a bear, an eagle, and other animals. These form the Totem or arms of the family.

Further particulars are given in the following letter announcing the shipment of the specimen :—

DEPUTY PROVINCIAL SECRETARY, BRITISH COLUMBIA, to ROYAL GARDENS, KEW.

Provincial Secretary's Office, Victoria,
March 8, 1898.

SIR,

REFERRING to prior correspondence respecting the desire expressed by yourself to obtain a specimen of the decorative

door-post in use by the natives of this Province, for deposit in the Museum at Kew Gardens, I have the honour, by direction, to forward herewith a bill of lading for one case containing a Totem-pole shipped by the barque "Seestern," which sailed for London on the 15th November last.

I also send by current post two photographs taken by Dr. Charles F. Newcombe, M.D., who purchased the post on behalf of this Government. Of these, one shows part of the deserted village of Tanoo, Moresby Island, one of the group forming the Queen Charlotte Islands, where the Totem was bought, and the other shows it *in situ* standing in front of the house to which it belonged.

Dr. Newcombe further reports that "the Totem-pole formed the front and only entrance to the house of Mrs. Thomas Moody. It is made of Cedar (*Thuya gigantea*) and is about 20 years old. Its position with regard to the frame of the house is shown in photograph No. 1. Between the ears of the Totem projected the end of the ridge pole which rested on the top of the Totem helping to keeping it in place. The pole was, furthermore, set about four feet in the ground, but had very slight support from the building. It represents the crest of the late owner's family, an eagle over another animal, species unknown."

I am, etc.,
(Signed) A. CAMPBELL REDDIE,
Deputy Provincial Secretary.

The Director,
Royal Gardens, Kew.

Kola in the Lagos Hinterland.—In an account of a tour made last year by Messrs Leigh and Dawodu at the request of the Government of Lagos, to instruct the natives in right methods for extracting rubber from *Kickxia africana* without destroying the trees, the following particulars are given by Mr. Dawodu of of Kola trees (*Cola acuminata*) met with during the journey :—

"We left Ile-Ife and Modakeke on the 7th April and went to Ikere, an important town in the Ekiti country, and a centre of the rubber industry. The route was through forest and hilly lands where the vegetation had quite a different aspect from that previously seen. The Kola-nut tree (the Abata variety) abounded in these parts and one often walked through groves of it before entering a town. The trees were all in a most flourishing condition, always bearing heavy and abundant crops. Indeed the Ekiti country is famed for its Kola trees and the cultivation of them is brought to great perfection by the natives."

Gutta Percha.—The series of Cantor Lectures on Gutta Percha delivered before the Society of Arts by Dr. Eugene Obach in November and December last has now been published in a separate volume with numerous illustrations. It forms an exhaustive summary of all that pertains to the gutta percha industry and contains numerous appendices with analytical and statistical tables. The assistance afforded by Kew is fully acknowledged.

The tree, the inspissated juice of which yields commercial gutta percha, was first brought into notice in 1842 by Dr. Montgomerie. Botanically it was made known in 1847 by Sir William Hooker who figured and described it under the name of *Isonandra Gutta* in the *London Journal of Botany*, vol. vi. (1847), p. 463, t. 16, from specimens contributed by Mr. Thomas Lobb and Dr. Oxley of Singapore. It was afterwards placed under the genus *Dichopsis* by Bentham in *Genera Plantarum*, ii., p. 658. *Dichopsis Gutta* is figured and described in Bentley and Trimen's *Medicinal Plants*, t. 167. It is also included under Sapotaceæ in the recently completed *Flora of British India*, vol. iii., p. 543. It is the *Palaquium Gutta* of continental botanists.

The plant has been grown at Kew for many years and has been sparingly distributed to botanical institutions in the New World. It is, however, difficult of treatment and appears to thrive well only within its natural habitat in the Malay Archipelago. Samples of raw and manufactured gutta percha are shown in Case 68 in Museum 1.

Dr. Ernst Werner von Siemens employed gutta percha for the electric insulation of subterranean telegraph lines in 1847 and since that time this interesting substance has been largely used for a variety of purposes but still chiefly in the manufacture of telegraph cables.

According to Dr. Obach the imports of raw gutta percha into the United Kingdom during the last thirty years have been as follows: 1865, 1,710 tons; 1875, 950 tons; 1885, 2,700 tons, and 1895, 2,610 tons. The total imports for the years 1844 to 1896 inclusive amounted to 82,607 tons, an average of 1,559 tons per annum.

The price for raw gutta percha of first quality such as Pahang, has been fairly uniform of late years. During the period from 1889 to 1896 inclusive it has only varied from 3*s*. 3*d*. to 3*s*. 9*d*. per pound.

The occurrence of trees of gutta percha at Singapore was noticed in the *Kew Bulletin* (1891, p. 230); an account of a new process for extracting gutta percha from the leaves was also given (*K. B.* 1891, p. 231, and 1897, p. 200). The possibility of obtaining gutta percha from two Indian trees, *Dichopsis obovata* and *D. elliptica* was discussed in the *Kew Bulletin*, 1892 (pp. 215 and 296).

With regard to the process referred to above Dr. Obach made the following remarks:—

"A tree ten years old yields about 15 lbs. of dry leaves; one thirty years old, about 25 lbs., *i.e.*, 1 lb. more for every two years it advances in age. If, therefore, the leaves of a tree were regularly plucked every year from the age of ten till it reaches maturity at thirty, it would have produced 420 lbs. of leaves, and as I have found that the dry leaves contain between 9 and 10 per cent. of gutta percha, this would correspond to about 40 lbs., that is, at least twenty times as much as would be obtained from a tree of the same age, when felled and bled in the customary way. This result, even if only partly realisable, would, in practice, be of enormous value to the gutta-planter." (*Journal of the Society of Arts*, Jan. 7, 1898, p. 153).

As stated in the *Kew Bulletin* (1897, p. 337), Gutta Percha "is a very troublesome plant to propagate by cuttings, but this can be done." However, Mr. Ridley, the Director, Gardens and Forest Department, Singapore, states that "the tree always comes up again when cut down." The following further information seems to point to greater success in propagation :—

EXTRACT from letter from Director, Gardens and Forest Department, Singapore, to Royal Gardens, Kew, dated February 16, 1898.

"A native recently brought some cuttings of Gutta Percha from Borneo which seem to be very strong. They appear to be cut from pretty thick boughs and coated over with wet mud, and apparently are very healthy, putting out strong shoots. I will find out how it is done, as it seems more successful than anything I have previously seen."

The Toonu or Tunu.—In consequence of a misconception of the application of the native name "tunu" in British Honduras, some confusion has arisen, for which Kew is partly responsible. In Dr. D. Morris's *Colony of British Honduras* it is stated (p. 74) that this is the native name of *Castilloa elastica*, the principal rubber tree of the country. It is now known, however, that the name is properly applied to another species ; still imperfectly known botanically. Planters sent specimens of *Castilloa elastica* as the "tunu," so that in the absence of adequate specimens of the true "tunu" it has been assumed at the Herbarium that only one species was concerned, and this opinion has been communicated to various persons. The increasing interest in rubber plants led to a re-examination of all the material in the Herbarium and Museum, with the result of ascertaining that two species of *Castilloa* exist in British Honduras. This was partly established by Sir Joseph Hooker (*Trans. Linn. Soc. Bot. 2nd series*, ii., pp. 209–215, plates 27 and 28), where he describes and figures four forms of *Castilloa*, including the "tunu ;" but he does not attempt to decide their rank. What he regarded as typical, *C. elastica*, is described at some length, and its distribution given as Mexico, from lat. 21° southward, through Guatemala, San Salvador, Honduras, Nicaragua and Costa Ricá. This bears the name of "ule," in some parts at least of this area. His number 2 is the "caucho," or Darien rubber plant, which Markham refers to (*Peruvian Bark*, p. 453) as *Castilloa markhamiana*, Collins, a very different plant, and probably not of the same genus. Sir Joseph Hooker's paper is illustrated by a coloured figure of the Darien plant, as cultivated in Ceylon. This is not specifically different from *Castilloa elastica*. Number 3, of which only the fruit is figured, is from Honduras, and is also undistinguishable from *C. elastica*. Number 4, of which only the fruit was known to Sir Joseph Hooker, is the "tunu" of Honduras. It differs essentially from *C. elastica* in the ovaries and drupelets being completely embedded in the receptacle. In all the forms of *C. elastica* the drupelets are easily separated. Since the publication of Sir Joseph Hooker's paper, Kew has received some leaves of a tree from Mr. Rowland W. Cater, which he

states is known locally in British Honduras as "tuno," "chaperna," and "divers other names." It was at first supposed that these might be old leaves of *Castilloa elastica*, but a more careful examination proves that they are not, confirming Mr. Cater's view, and there is little doubt that they belong to the same species as the fruit figured as the "tuno" by Sir Joseph Hooker. In order to make quite sure, measures have been taken to procure complete specimens from one and the same tree. The tuno is also known as the "male rubber tree," and the "sterile rubber tree." As the male and female flowers are sometimes, at least, borne on different trees, there may be something more to learn concerning the application of these names.

In addition to the localities given above for *Castilloa elastica*, there are specimens in the Kew Herbarium, collected by Richard Spruce, labelled as follows: "6351. *Castilloa.* Arbor 60 pedalis, lactescens. 'Jeve' Guayaquilensium. In planitie guayaquilensi præcipue secus radices montis Chimborazo, Decr., 1860." "Jeve" or "heve" seems to be a generic name for rubber trees, as Aublet, in founding his genus *Hevea* (*Hist. Pl. Guiane Fr.*, p. 872) says: "Cet arbre est nommé siringa par les Garipons; hévé par les habitans de la province d'Esmeraldas au nord-ouest de Quito, et caoutchouc par les Maïnas."

Judging from the material in the herbaria of Kew and the British Museum there are two species of the genus *Castilloa*, namely: *C. elastica*, ranging from Mexico to Ecuador, and the "tunu," at present undescribed.—W.B.H.

Brunfelsia calycina.—Brunfelsias are highly ornamental and floriferous shrubs well adapted for the warm greenhouse. The species have been unduly multiplied by horticulturists. These must be united and the question arises which name should be adopted for the aggregate. *B. pauciflora*, Benth, is, in a sense, the oldest name, as it was previously used (1827) under *Franciscea*: but it is of the same date under *Brunfelsia* as *B. calycina.* That being so, and the latter name being much more familar, and less inappropriate, it should be adopted. The genus *Brunfelsia* is greatly in need of a critical revision, which would doubtless result in a considerable reduction of the number of species. *Brunfelsia calycina*, Benth. (*DC. Prodr.* x. p. 199), Franciscea calycina, *Hook.* (*Bot. Mag.* t. 4583) should include *B. pauciflora*, Benth. (*DC. Prodr.* x. p. 199), and *B. eximia*, Bosse (*Handb. Blumeng.* i. p. 524), Franciscea eximia, Scheidw. (*Bot. Mag.* t. 4790). To these should probably be added *Franciscea lindeniana*, Planch. (*Belg. Hort.* xv. p. 226 cum ic. color.), and *F. macrantha*, Lem. (*Ill. Hort.* i. t. 24.). Schmidt (*Mart. Fl. Bras.* viii. i. p. 256), reduces *B. eximia*, Bosse, to *B. macrophylla*, Benth., of which Kew possesses no authenticated specimen, Bentham having merely removed it from *Franciscea* without seeing it.

Paraguay tea.—Notes on the botany of the plants yielding Paraguay tea or Maté were published in the *Kew Bulletin* (1892, pp. 132–137). In the following year it was noted (*K. B.* 1893,

p. 367) that seeds of what was believed to be true *Ilex paraguensis* had been received through the kindness of Señor Glaziou, Director de Passeio publico, Rio de Janeiro. After retaining a few the others were distributed to various Botanical Institutions in the Colonies. Unfortunately none of the seeds sown at Kew germinated.

The following interesting information respecting the tea made from the leaves, so largely used in South America, is taken from a Report issued by the Foreign Office (No. 1963, 1897) :—

"Yerba-maté, or Paraguayan tea, is the most valuable article of export. There are two classes sold, but it is only in the manner of preparation that they differ. The kind known as 'Mborovirè' is merely dried over a furnace, and then beaten into small pieces with sticks. The 'Molida' goes through the same process, but it is afterwards ground in a mill. The export duty on the former was increased in 1895 from 30 c. paper to 10 c. gold, and on the latter from 25 c. paper to 9 c. gold per 10 kilos. The revenue derived from this source in 1895 amounted to 471,668 dol. (16,845*l.*). The yerba forests, called yerbales, were formerly the property of the State, but most of them have been sold, and are now in the hands of a few capitalists and companies. The Industrial Paraguaya Company, which owns about half of the yerbales known to exist in the country, exports annually about 400,000 arrobas (4,512 tons). The total quantity of yerba exported during the past year is estimated at about 9,024 tons, and the average price per arroba (25 lbs.) was 11 dol. 50 c. paper (7*s.* 8*d.*)."

Paraguay tea is now advertised for sale in this country and appears to be in moderate demand ; possibly, as a curiosity more than as a regular article of food.

Malingering in Egypt.—The most varied problems are submitted to Kew, and the following is one of the most curious. Unfortunately but little success has been attained in solving it. The particulars are, however, recorded in the hope that this may lead to some further light being thrown on the matter. The specimens were carefully examined by Dr. Scott, F.R.S., Honorary Keeper of the Jodrell Laboratory, who could only conjecture that they were fragments of the paleæ of some grass.

EXTRACT from letter from Mr. KENNETH SCOTT to Royal Gardens, Kew, dated Cairo, Egypt, November 28, 1897.

"For some time now malingering Egyptian soldiers have been sent in to the Kasr-el-Aini hospital under my care, suffering from extreme oedema and intense inflammatory injection of the conjunctiva of one or both eyes ; the *cornea unaffected.* No discharge from the eye.

"The condition is entirely unlike that which they also produce by putting in the juice of Euphorbia, slaked lime, seed of 'melocheeya' (*? Corchorus olitorius*) and other things.

"I obtained the specimens sent you by covering the eye with a thick collodion dressing so as to completely seal it up. The man

at the end of five days had evidently feared the inflammation might subside and therefore raised the dressing and renewed the baneful application, part of which I found on the face of the dressing lying against the eye.

"I have been entirely unsuccessful in obtaining here any information on the matter, nor have I been able to obtain further quantities of the leaf. The patient either began to fear the consequences of the affair or his stock of the drug became exhausted as he in no way interfered with the next collodion dressing which was applied, the eye being quite cured, and the dressing intact after a period of five days.

A Chinese prescription.—Mr. J. Burtt Davy, formerly a member of the Kew staff, and now attached to the University of California, Berkeley, U.S.A., has presented to the Kew Museum the ingredients of a Chinese prescription purchased by him at China Town, San Francisco. As is well known, the Chinese use a very large and varied assortment of products in the preparation of their medicines, and Mr. Davy says that, in the drug stores of China Town, one can usually obtain a panacea for all ills, varying in the number of ingredients according to the price paid (25, 35, or 50 cents). Such a prescription usually contains a few slices of the root of *Glycyrrhiza*, dried flower-heads of a composite plant, dried cockroaches, dried cockchafers, and the skin, head and tail of a lizard stretched on thin sticks; an extra five cents will procure a dried "Sea horse"; and yet another five cents a dried fish of peculiarly narrow shape, and about four inches in length. All these are boiled together, and the decoction drunk as a remedy for heartburn, toothache, cough, dimness of sight, and almost any other ailment. It is difficult to identify most of the vegetable ingredients in consequence of their being cut or broken up into small fragments, but the following occur amongst those brought to Kew. Fruit heads of an *Eriocaulon*, apparently *E. cantoniense*. This plant has a reputation in China for various diseases, such as ophthalmia, especially in children, as a styptic in nose bleeding, and in affections of the kidney. Another ingredient, capable of identification, consists of the spiny hooks from the stems of the Gambier plant (*Uncaria Gambier*, Roxb.), which have astringent properties, and are mostly used in infantile complaints. Some very thin transverse sections of the stem of *Akebia quinata*, a climbing berberidaceous plant, also occur in small quantities, as well as the bark of *Eucommia ulmoides*, known as the "Tu Chung." Tonic and invigorating properties are ascribed to it, and it is said to be valued at as much as 4*s*. to 8*s*. per pound. Though the bark is very thin, it is abundantly charged with elastic gum, which can be drawn out in silvery threads when it is broken apart. Among other ingredients which have not been identified are crushed flower heads of a composite plant, and slices of a slender, twig-like stem, probably a willow.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 139.] JULY. [1898.

DCXI.—DIAGNOSES AFRICANÆ, XI.*

600. **Trimeria tropica**, *Burkill* [Bixineæ]; *T. alnifoliæ*, Planch., similis, foliis ovatis acuminatis differt.

Arbor vel frutex inermis. *Rami* juniores pubescentes. *Folia* utrinque, præsertim subtus in venis, pilis albidis vestita; petiolus ½ poll. longus; lamina ovata vel obovata, basi subcordata, apice acuta, breviter acuminata, margine minute dentata, 2½ poll. longa, 1½ poll. lata; stipulæ transverse ellipticæ, majores 4 lin. longæ, 6 lin. latæ, apice minute mucronatæ, utrinque pubescentes. *Spicæ* flores masculinos gerentes nunc simplices, floribus in glomerulos aggregatis, nunc e glomerulis basalibus breviter ramosæ. *Flores masculini* tetrameri, sessiles vel brevissime pedunculati. *Sepala* minuta, lanceolata, ⅓ lin. longa, extus pilis dense obtecta. *Petala* sepalis consimilia, paulo majora, flore expanso margine involuta. *Stamina* 12, inter glandulas subglobosas apice indistincte 3–4-dentatas 3-na inserta. *Ovarium* imperfectum tenue, in stylum leviter curvatum staminibus subæquilongum productum. *Flores feminei* ignoti.

GERMAN EAST AFRICA. Amboni, *Holst*, 2582.

The extension of this genus from South Africa into the tropics is of interest.

601. **Oldenlandia acutidentata**, *C. H. Wright* [Rubiaceæ-Hedyotideæ]; ad *O. grandifloram*, Hiern, accedit, sed cymis subcapitatis et calycis lobis longe subulatis differt.

Caulis erectus, pedalis, scaber, subtus lignosus. *Folia* anguste lanceolata, acuta, 1–1½ poll. longa, 1–2 lin. lata, scabra; stipulæ fimbriatæ, 4–5-dentatæ. *Cymæ* congestæ, sæpe subcapitatæ. *Calyx* pilosus, dentibus subulatis ciliatis tubo triplo longioribus. *Corolla* extus pilosa, 5 lin. longa, cærulea?, lobis ovatis acutis reticulatim nervatis. *Stamina* inclusa, antheris oblongis. *Ovarium* globosum. *Fructus* 2 lin. diam.

BRITISH CENTRAL AFRICA. Mount Zomba, alt. 4000–6000 ft., *Whyte*.

* The altitudes given for Mr. Forsyth Major's new Madagascar plants, *Kew Bulletin*, 1897, pp. 276, 281, and 300, should be yards instead of feet.

110—1375—7/98 Wt 90 D & S 29

602. **Vernonia (Decaneurum) amblyolepis,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. glabram*, Vatke, accedit, sed differt ramulis pubescentibus, involucri bracteis pilosis.

Herba perennis, erecta, ramosa. *Caulis* lignosus, breviter pilosus. *Folia* sessilia, oblongo-lanceolata, 3–4 poll. longa, acuta, obscure crenata, facie viridia scabra, dorso dense breviter pilosa, venis elevatis. *Capitula* parva, ad apices ramorum dense corymbosa, brevissime pedunculata. *Involucrum* campanulatum, 4–4½ lin. longum, bracteis rigidis obtusis pluriserialibus leviter pilosis, interioribus linearibus, exterioribus ovatis. *Achænia* cylindrica, dense pilosa. *Pappus* setosus, albidus, 3 lin. longus, setis exterioribus brevibus.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 204; and between Mpata and the commencement of the Nyasa-Tanganyika plateau, alt. 2000–3000 ft., *Whyte.*

603. **Vernonia asterifolia,** *Baker*, [Compositæ-Vernoniaceæ]; ad *V. monocephalam*, Harv., capensem magis accedit, sed differt involucri bracteis lanceolatis haud acuminatis.

Herba perennis, erecta. *Caules* graciles, monocephali, subpedales, simplices vel parce ramosi. *Folia* sessilia, lanceolata, ascendentia, 1–1½ poll. longa, integra vel raro parce dentata, utrinque viridia, tenuiter pubescentia. *Capitula* magna, solitaria, longe pedunculata. *Involucrum* campanulatum, 4 lin. longum, bracteis pauciserialibus appressis lanceolatis acutis pubescentibus, exterioribus sensim brevioribus. *Achænia* immatura leviter pilosa. *Pappus* stramineus, fragilis, setosus, 2 lin. longus.

BRITISH CENTRAL AFRICA. Zomba, alt. 2500–3500 ft., *Whyte.*

604. **Vernonia (Lepidella) Buchanani,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. Bainesii*, Oliv., arcte accedit, sed differt foliis subulatis tenuissimis.

Herba perennis. *Caules* graciles, ramosi, subpedales, ad apicem foliati, sursum obscure pubescentes. *Folia* sessilia, subulata, 6 lin. longa, appresse pubescentia, gracilia, marginibus revolutis. *Capitula* magna, ad apices ramorum solitaria. *Involucrum* campanulatum, 6 lin. longum, bracteis appressis pluriserialibus leviter pubescentibus, exterioribus ovatis, interioribus rubellis chartaceis linearibus. *Corolla* rubella, lobis linearibus. *Achænia* immatura albo-setosa. *Pappus* albus; series interior setosa, 3 lin. longa, series exterior parvis paleis effecta.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 160; and between Mpata and the commencement of the Nyasa-Tanganyika plateau, alt. 2000–3000 ft., *Whyte*; Shire Highlands, *Buchanan*, 139 of 1878 collection.

605. **Vernonia (Lepidella) chloropappa,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. poskeanam*, Vatke et Hildeb., accedit, sed differt pappo viridi, involucri bracteis inappendiculatis.

Herba perennis, erecta. *Caules* graciles, ramosi, sursum pubescentes. *Folia* pauca, remota, sessilia, linearia, 6–12 lin. longa, integra, marginibus revolutis, facie viridia glabra, dorso tenuiter

pubescentia. *Capitula* magna, laxe corymbosa, longe pedunculata. *Involucrum* campanulatum, 5 lin. longum, bracteis pauciserialibus rigidis lanceolatis pubescentibus, exterioribus sensim brevioribus. *Achænia* pilosa, 1 lin. longa. *Pappus* biserialis, pallide viridis; series interior setis 2 lin. longis, series exterior paleis parvis effecta.

BRITISH CENTRAL AFRICA. Fort Hill, Nyasa-Tanganyika plateau, alt. 3500–4000 ft., *Whyte.*

606. **Vernonia (Decaneurum) exsertiflora,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. amygdalinam*, DC., accedit, sed differt ramulis albo-incanis, capitulis 7–8-floris.

Frutex erectus, ramosus. *Ramuli* lignosi, albo-incani, remote foliati. *Folia* petiolata, oblonga, 4–7 poll. longa, acuta, basi attenuata, integra, penninervia, venis primariis parallelis erecto-patentibus, facie viridia glabra, dorso pubescentia. *Capitula* parva, 7–8-flora, dense corymboso-paniculata, pedunculis brevissimis. *Involucrum* oblongum, 2 lin. longum, bracteis rigidis glabris arcte appressis, interioribus lineari-oblongis, exterioribus sensim brevioribus. *Achænia* cylindrica, dense pubescentia, 1½ lin. longa. *Pappus* albus, flexuosus, setosus, 4 lin. longus, ex involucro longe exsertus.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte*, 95.

607. **Vernonia (Cyanopis) karongensis,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. Leopoldi*, Vatke, accedit, sed differt involucri bracteis setaceis dense plumosis.

Herba perennis, erecta. *Caules* ramosi, sursum dense appresse pubescentes. *Folia* sessilia, lanceolata, minute serrata, 3–4 poll. longa, ad basin angustata, utrinque pubescentia. *Capitula* multiflora, pauca, ad apices ramorum corymbosa. *Involucrum* campanulatum, 3 lin. longum, bracteis 3–4-serialibus appressis setaceis dense albo-plumosis. *Achænia* immatura glabra. *Pappus* albidus, 2 lin. longus, biserialis; series interior setosa, series exterior paleis parvis lanceolatis effecta.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte.*

608. **Vernonia (Stengelia) leptolepis,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. tenoreanam*, Oliv., accedit, sed differt involucro glabro.

Suffrutex erectus, ramosus. *Ramuli* lignosi, sursum leviter pubescentes. *Folia* distantia, sessilia, oblongo-lanceolata, 4–6 poll. longa, minute serrata, facie viridia obscure pubescentia, dorso dense pubescentia. *Capitula* magna, ad apices ramorum solitaria vel 2–3 corymbosa. *Involucrum* campanulatum, 9–12 lin. longum, bracteis pauciserialibus appressis glabris chartaceis oblongo-lanceolatis vel lanceolatis apice membranaceis acutis. *Achænia* 1½ lin. longa, cylindrica, pilosa, multicostata. *Pappus* stramineus, setosus, fragilis, 5–6 lin. longus.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte.*

609. **Vernonia (Tephrodes) malosana,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. cineream*, Less., accedit, sed differt involucri bracteis paucis æquilongis, achæniis distincte costatis.

Herba perennis. *Caules* erecti, ramosi, pilosi. *Folia* subsessilia, ovata, 1–2 poll. longa, acuta, serrata, utrinque viridia, facie tenuiter, dorso magis pilosa. *Capitula* parva, pauciflora, dense corymbosa, pedunculis brevibus pilosis. *Involucrum* campanulatum, 2 lin. longum, bracteis appressis æquilongis oblongo-lanceolatis foliaceis viridibus dense pilosis. *Achænia* cylindrica, angulata, glabra, 1½ lin. longa, 8–10-costata. *Pappus* copiosus, setosus, stramineus, 3 lin. longus.

BRITISH CENTRAL AFRICA. Mounts Malosa and Zomba, alt. 4000–6000 ft., *Whyte*.

610. **Vernonia (Decaneurum) myriotricha,** *Baker* [Compositæ-Vernoniaceæ]; ad *V. Hochstetteri*, Sch. Bip., accedit, sed differt involucro dense piloso.

Suffrutex ramosissimus, erectus. *Ramuli* lignosi, dense pilosi. *Folia* sessilia, oblonga, obtusa vel acuta, basi cordata, minute serrata, superiora 1½–2 poll. longa, facie viridia dense pilosa, dorso dense persistenter molliter albido-incana. *Capitula* multiflora, ad apices ramorum dense corymbosa. *Involucrum* campanulatum, dense pilosum, 2 lin. longum, bracteis pauciserialibus appressis rigidulis lanceolatis. *Achænia* glabra, multicostata. *Pappus* albidus, setosus, 2 lin. longus.

BRITISH CENTRAL AFRICA. Masuku plateau, alt. 6500–7000 ft., *Whyte*, 293.

611. **Vernonia polysphæra,** *Baker* [Compositæ-Vernoniaceæ]; a speciebus reliquis differt capitulis in glomerulos axillares sessiles congestis.

Frutex erectus. *Ramuli* virgati, graciles, lignosi, glabri. *Folia* sessilia, rigide coriacea, parce serrata, utrinque viridia, glabra, inferiora oblonga 3 poll. longa, superiora multo minora lanceolata. *Capitula* parva, in glomerulos globosos axillares congestos sessiles aggregata. *Involucrum* campanulatum, 3 lin. longum, bracteis rigidis appressis acutis, exterioribus parvis acutis, intimis lanceolatis. *Achænia* cylindrica, dense pilosa. *Pappus* copiosus; series interior setosa, straminea, 3 lin. longa, series exterior parvis paleis effecta.

BRITISH CENTRAL AFRICA. Near Fort Hill, Nyasa-Tanganyika plateau, alt. 3500–4000 ft., *Whyte*.

612. **Ageratum polyphyllum,** *Baker* [Compositæ-Eupatoriaceæ]; ab *A. conyzoide*, Linn., longe recedit habitu perenni, foliis sessilibus angustis integris.

Herba perennis. *Caules* simplices, erecti, pubescentes, crebre foliati. *Folia* opposita, sessilia, ascendentia, lanceolata, 6–12 lin. longa, marginibus revolutis integris, facie viridia glabra, dorso griseo-incana. *Capitula* multiflora, homogama, discoidea, in corymbos densos aggregata. *Involucrum* campanulatum, 2 lin.

diam., bracteis pauciserialibus appressis lanceolatis dense pubescentibus, exterioribus sensim brevioribus. *Corolla* saturate rubra, tubo pubescente 1 lin. longo, lobis lanceolatis recurvatis. *Achænia* cylindrica, glabra. *Pappi paleæ* paucæ, obtusæ, corollæ tubo triplo breviores.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 252.

613. **Nidorella malosana,** *Baker* [Compositæ-Asteroideæ]; ad *N. microcephalam*, Steetz, accedit.

Herba perennis. *Caules* stricti, erecti, pilosi, pedales, ad apicem foliati. *Folia* alterna, sessilia, ascendentia, lanceolata vel oblongo-lanceolata, integra, obscure viridia, facie glabra, dorso ad costam pilosa, centralia 1 poll. longa, superiora et inferiora minora. *Capitula* subdiscoidea, in corymbos terminales aggregata. *Involucrum* campanulatum, $1\frac{1}{2}$ lin. longum, bracteis pauciserialibus æquilongis oblanceolatis obscure brunneis leviter pubescentibus. *Corolla* lutea, pappo æquilonga, sæpissime cylindrica, lobis parvis ovatis. *Achænia* subcylindrica, angulata, pilosa, 1 lin. longa. *Pappus* copiosus, setosus, albidus, $1\frac{1}{2}$ lin. longus.

British Central Africa. Mount Malosa, alt. 4000–6000 ft., *Whyte*.

614. **Helichrysum luteo-rubellum,** *Baker* (Compositæ-Inuloideæ]; ad *H. Kirkii*, Oliv. et Hiern, magis accedit.

Herba perennis, erecta, ramosa. *Rami* ascendentes, albo-incani, ad apicem crebre foliati. *Folia* sessilia, ascendentia, linearia, 6–9 lin. longa, facie viridia obscure albo-pubescentia, dorso dense persistenter albo-incana. *Capitula* ad apices ramulorum solitaria vel pauca corymbosa. *Involucrum* campanulatum, 6 lin. longum, bracteis 3–4-serialibus scariosis appressis glabris, interioribus lanceolatis citrinis, exterioribus parvis ovatis rubellis. *Flores* omnes hermaphroditi. *Corolla* angusta, cylindrica, 2 lin. longa. *Achænia* minuta, glabra. *Pappus* sulphureus, setosus, 2 lin. longus.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*.

615. **Helichrysum monocephalum,** *Baker* [Compositæ-Inuloideæ]; ad *H. Newii*, Oliv. et Hiern, magis accedit.

Herba perennis. *Caules* graciles, erecti, simplices, subpedales, albo-incani, ad apicem crebre foliati. *Folia* sessilia, linearia, ascendentia, 9–12 lin. longa, facie parce, dorso dense albo-incana. *Capitula* magna, solitaria, terminalia, floribus omnibus hermaphroditis. *Involucrum* campanulatum, 9–10 lin. longum et latum, bracteis 3–4-serialibus appressis albidis scariosis, interioribus lineari-oblongis glabris, exterioribus parvis ovatis albo-incanis. *Corolla* cylindrica, lutea, pappo æquilonga. *Achænia* glabra, compressa, facie unicostata. *Pappus* mollis, albus, 2 lin. longus.

British Central Africa. South Nyika mountains, alt. 4000–7000 ft., and between Kondowe and Karonga, *Whyte*.

616. **Helichrysum nanum**, *Baker* [Compositæ-Inuloideæ]; ad *H. gerberæfolium*, Sch. Bip., accedit, sed differt caule brevi, foliis utrinque albo-incanis, involucri bracteis aureis acutis.

Herba perennis. *Caules* infra paniculam simplices, 3–5 poll. longi, dense albo-incani. *Folia* radicalia erecta, longe petiolata, oblongo-lanceolata, 1½–2 poll. longa, acuta, ad basin angustata, utrinque dense persistenterque albo-incana; folia caulina pauca, sessilia, parva, linearia. *Capitula* parva, multiflora, in paniculam densam globosam terminalem aggregata, pedunculis brevissimis. *Involucrum* campanulatum, 2–2½ lin. longum, basi albo-lanosum, supra basin glabrum, bracteis appressis subæquilongis oblongis acutis aureis. *Achænia* minuta, glabra. *Pappus* albidus, flexuosus, 1½ lin. longus.

British Central Africa. Mount Malosa, near Zomba, alt. 4000–6000 ft., *Whyte*.

617. **Helichrysum nyasicum**, *Baker* [Compositæ-Inuloideæ]; ad *H. auriculatum*, Less., arcte accedit.

Herba perennis, erecta. *Caules* teretes, simplices vel furcati, albo-araneosi, ad apicem foliati. *Folia* breviter petiolata, ovata, acuta, basi rotundata, 1–1½ poll. longa, subcoriacea, facie saturate viridia leviter araneosa, dorso dense persistenter albido-incana. *Capitula* parva, permulta, in corymbum densum terminalem aggregata, pedicellis brevibus dense pubescentibus. *Involucrum* campanulatum, 2½–3 lin. diam., bracteis 3–4-serialibus ovatis appressis scariosis albidis, exterioribus sensim brevioribus, floribus omnibus hermaphroditis. *Achænia* glabra, compressa, oblonga. *Pappus* copiosus, setosus, albidus, 1½ lin. longus.

British Central Africa. Shire highlands, *Buchanan*, 313, 341, 812 of 1891 collection; Mount Zomba, alt. 4000–6000 ft., *Whyte*.

618. **Helichrysum patulifolium**, *Baker* [Compositæ-Inuloideæ]; ad *H. quartinianum*, A. Rich., magis accedit.

Herba perennis. *Caules* erecti, albo-incani, ad apicem crebre foliati. *Folia* densa, sessilia, patula, linearia, rigidula, 6–9 lin. longa, facie viridia leviter araneosa, dorso dense albo-incana, marginibus revolutis ciliatis. *Capitula* plura, corymbosa. *Involucrum* campanulatum, 2 lin. longum, bracteis 3–4-serialibus appressis citrinis leviter pilosis, intimis lanceolatis, exterioribus ovatis parvis. *Achænia* minuta, glabra. *Pappus* setosus, albus, 1 lin. longus.

British Central Africa. South Nyika mountains, alt. 4000–6000 ft., *Whyte*.

619. **Helichrysum rhodolepis**, *Baker* [Compositæ-Inuloideæ]; ad *H. gerberæfolium*, Sch. Bip., accedit, sed differt involucri bracteis exterioribus rubris, intimis albis.

Herba perennis, erecta. *Caules* infra inflorescentiam simplices, 2–3-pedales, albo-incani, laxe foliati. *Folia* radicalia longe petiolata, oblongo-lanceolata, 4–6 poll. longa, medio 1½–2 poll. lata, acuta, ad basin attenuata, facie viridia, dorso persistenter

albo-incana; folia caulina sessilia, lanceolata vel linearia. *Capitula* parva, pauciflora, permulta, in glomerulum globosum terminalem aggregata. *Involucrum* campanulatum, 2 lin. longum, bracteis æquilongis oblongis obtusis, interioribus albis glabris, exterioribus rubris deorsum albo-lanosis. *Achænia* parva, glabra. *Pappus* albus, 1½ lin. longus.

BRITISH CENTRAL AFRICA. Plains of Zomba, alt. 2500–3000 ft., *Whyte.*

620. **Helichrysum sulphureo-fuscum,** *Baker* [Compositæ-Inuloideæ]; ad *H. Buchanani*, Engl., magis accedit.

Herba perennis, e basi ramosissima. *Caules* erecti, simplices, semipedales, ad apicem laxe foliati. *Folia* plana, linearia, facie viridia glabra, dorso dense albo-incana, radicalia 1½ poll. longa, caulina breviora. *Capitula* magna, homogama, solitaria, terminalia. *Involucrum* campanulatum, 8–9 lin. longum, bracteis 3–4-serialibus glabris appressis scariosis apice atro-fuscis basi sulphureis, interioribus lanceolatis, exterioribus ovatis parvis. *Corolla* cylindrica, 2 lin. longa. *Achænia* glabra, minuta. *Pappus* setosus, albidus, fragilis, 2 lin. longus.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 132.

621. **Helichrysum syncephalum,** *Baker* [Compositæ-Inuloideæ]; ad *H. auriculatum*, Less., accedit, sed differt foliis bullatis, capitulis paucifloris.

Herba perennis. *Caules* erecti, ramosi, dense albo-lanosi, ad apicem laxe foliati. *Folia* caulina subpetiolata, oblongo-lanceolata, 2–3 poll. longa, acuminata, leviter bullata, ad basin attenuata, facie viridia, costam secus pilosa, dorso dense persistenter albo-incana. *Capitula* parva, pauciflora, ad apices ramorum dense corymboso-paniculata. *Involucrum* oblongum, 1½ lin. longum, bracteis pauciserialibus oblongis obtusis appressis æquilongis. *Achænia* minuta, glabra. *Pappus* albus, flexuosus, 1 lin. longus.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte*, 370.

622. **Helichrysum xanthosphærum,** *Baker* [Compositæ-Inuloideæ]; ad *H. Kirkii*, Oliv. et Hiern, magis accedit.

Herba perennis, erecta, ramosa. *Caules* dense albo-pubescentes, ad apicem crebre foliati. *Folia* sessilia, lanceolata, ascendentia, 12–18 lin. longa, utrinque dense persistenter albo-araneosa. *Capitula* terminalia, solitaria vel pauca corymbosa. *Involucrum* campanulatum, 9 lin. longum, bracteis 3–4-serialibus appressis scariosis splendide citrinis glabris, intimis lanceolatis, exterioribus parvis ovatis, capitulis omnibus hermaphroditis. *Achænia* minuta, glabra. *Pappus* albus, setosus, 2 lin. longus.

BRITISH CENTRAL AFRICA. Between Mpata and the commencement of the Nyasa-Tanganyika plateau, alt. 2000–3000 ft., *Whyte.*

623. **Athrixia diffusa,** *Baker* [Compositæ-Inuloideæ] ; ad *A. debilem*, DC., magis accedit.

Herba perennis, ramossisima. *Caulis* primarius erectus, semipedalis, ramis patulis strictis gracilibus albo-pubescentibus et nigro-setosis. *Folia* sparsa, subteretia, 9–12 lin. longa, marginibus revolutis, facie viridia setis brevibus albis conspersa, dorso albo-incana. *Capitula* homogama, discoidea, ad apices ramulorum solitaria. *Involucrum* campanulatum, 3–4 lin. diam., bracteis rigidulis pauciserialibus lanceolatis albo-incanis, exterioribus leviter squarrosis. *Achænia* angulata, 1 lin. longa, villosa, ad basin attenuata. *Pappus* achænio æquilongus, multiserialis, paleaceus ; paleæ apice fimbriatæ.

British Central Africa. Fort Hill, Nyasa-Tanganyika plateau, alt. 3500–4000 ft., *Whyte.*

624. **Pulicaria tanganyikensis,** *Baker* [Compositæ-Inuloideæ] ; ad *P. vulgarem*, Gaertn., magis accedit.

Herba perennis, erecta. *Caules* ramosissimi, pubescentes, graciles, semipedales, ramulis ascendentibus. *Folia* linearia, integra vel subintegra, utrinque pubescentia, inferiora $1\frac{1}{2}$–2 poll. longa, superiora minora. *Capitula* heterogama, ligulata, ad apices ramulorum solitaria vel pauca corymbosa, pedunculis dense glanduloso-pubescentibus. *Involucrum* campanulatum, 2 lin. longum, bracteis biserialibus lanceolatis rigidulis pubescentibus, exterioribus parvis. *Ligulæ* parvæ, luteæ. *Achænia* minuta, compressa, glabra. *Pappus* setosus, albus, fragilis, 2 lin. longus.

British Central Africa. Near Fort Hill, Nyasa-Tanganyika plateau, alt. 3000–4000 ft., *Whyte.*

625. **Aspilia monocephala,** *Baker* [Compositæ-Helianthoideæ] ; ad *A. Kotschyi*, Benth. et Hook. fil., accedit, sed differt ligulis aurantiacis, achæniis glabris.

Herba perennis, erecta. *Caules* 6–7 poll. longi, graciles, pilosi, remote foliati, sæpissime simplices, monocephali. *Folia* sessilia, opposita, paucijuga vel superiora alterna, lanceolata vel oblongo-lanceolata, acuta, ascendentia, basi angustata, utrinque viridia, pilosa. *Capitula* heterogama, multiflora, radiata, longe pedunculata, sæpissime solitaria. *Involucrum* campanulatum, 5–6 lin. longum, bracteis pauciserialibus æquilongis oblongo-lanceolatis foliaceis dense pilosis. *Ligulæ* 3 lin. longæ. *Receptaculi paleæ* rigidæ, lanceolatæ, 4 lin. longæ. *Achænia* cylindrica, glabra. *Pappus* minutus, paleaceus.

British Central Africa. Zomba, *Whyte* and *McClounie.*

626. **Aspilia zombensis,** *Baker* [Compositæ-Helianthoideæ] ; ad *A. latifoliam*, Oliv. et Hiern, accedit, sed recedit involucro floribus discoideis breviore.

Herba perennis. *Caules* erecti, graciles, simplices, appresse pilosi, ad apicem laxe foliati. *Folia* opposita, decussata, brevissime petiolata, ovata, acuta, 1–$1\frac{1}{2}$ poll. longa, basi late rotundata, facie viridia scabra, dorso leviter pilosa. *Capitula* multiflora, heterogama, radiata, solitaria, terminalia. *Involucrum* campanulatum, 2 lin.

longum, bracteis pauciserialibus appressis lanceolatis pubescentibus. *Ligulæ* luteæ, angustæ, 2 lin. longæ. *Receptaculi paleæ* lanceolatæ, rigidulæ, 2 lin. longæ. *Achænia* cylindrica, glabra, apice pubescentia. *Pappus* obsoletus.

British Central Africa. Mount Zomba, alt. 4000–6000 ft., *Whyte.*

627. **Guizotia nyikensis,** *Baker* [Compositæ-Helianthoideæ] ; ad *G. abyssinicam*, Cass., accedit, sed recedit involucri bracteis omnibus magnis foliaceis.

Herba perennis, erecta. *Caulis* gracilis, glaber, sulcatus, ramosus, remote foliatus *Folia* opposita, sessilia, oblongo-spathulata, acuta, basi cordata, minute serrata, utrinque viridia, tenuiter pilosa, inferiora 3–4 poll. longa. *Capitula* multiflora, heterogama, ligulata, ad apices ramorum solitaria vel pauca conferta. *Involucri* bracteæ paucæ, ovatæ, inæquales, foliaceæ. *Ligulæ* luteæ, 5 lin. longæ, apice conspicue dentatæ. *Achænia* cylindrica, glabra. *Pappus* abortivus.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 198 ; Masuku plateau, alt. 6500–7000 ft., *Whyte.*

628. **Coreopsis aspilioides,** *Baker* [Compositæ-Helianthoideæ] ; ad *C. linearifoliam*, Oliv. et Hiern, accedit, sed recedit foliis lanceolatis scabris.

Herba perennis, erecta. *Caules* 1–2-pedales, ramosi, hispidi, remote foliati. *Folia* opposita, sessilia, lanceolata, 3–4 poll. longa, ascendentia, integra vel parce dentata, utrinque viridia, scabra. *Capitula* multiflora, heterogama, radiata, ad apices ramorum solitaria vel pauca corymbosa. *Involucrum* campanulatum, 4 lin. longum, bracteis æquilongis lanceolatis foliaceis hispidis. *Ligulæ* aurantiacæ, 6 lin. longæ, apice profunde fissæ. *Receptaculi paleæ* lanceolatæ, rigidæ, 3–4 lin. longæ. *Achænia* glabra. *Pappi paleæ* 2, parvæ, lanceolatæ.

British Central Africa. Zomba, alt. 2500–3500 ft., *Whyte.*

629. **Jaumea Johnstoni,** *Baker* [Compositæ-Helenioideæ] ; ad *J. Oliveri*, Vatke, et *J. Compositarum*, Benth. et Hook. fil., magis accedit.

Herba perennis, erecta, glabra. *Caulis* bipedalis, teres, gracilis, multisulcatus. *Folia* opposita, sessilia, oblongo-lanceolata, acuta, rigidula, basi cordata, inferiora 3 poll. longa, superiora sensim minora, venis facie inferiore elevatis. *Capitula* pauca, magna, laxe corymbosa, pedunculis elongatis nudis vel foliis parvis 1–2-jugis præditis. *Involucrum* campanulatum, 5–6 lin. longum, bracteis paucis biserialibus ovatis acutis appressis viridibus rigidulis. *Corolla* cylindrica, aurantiaca, 6 lin. longa, lobis lanceolatis. *Achænia* cylindrica, dense pilosa, 2 lin. longa. *Pappus* albidus, setosus, 4 lin. longus, setis subplumosis apice uncinatis.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 228; Masuku plateau, alt. 6500–7000 ft., and between Mpata and the Nyasa-Tanganyika plateau, alt. 2000–3000 ft., *Whyte.*

630. **Emilia basifolia,** *Baker* [Compositæ-Senecionideæ]; ad *E. cæspitosam*, Oliv., magis accedit.

Herba annua, pubescens. *Caules* cæspitosi, erecti, monocephali, 6–9 lin. longi, prope basin tantum foliati. *Folia* sessilia, ascendentia, oblonga vel oblanceolato-oblonga, obtusa, crenulata, ad basin attenuata, utrinque viridia, pubescentia, majora ½ poll. longa. *Capitula* solitaria, homogama, pedunculis nudis erectis semipedalibus. *Involucrum* campanulatum, uniseriale, bracteis 8–10 lanceolatis glabris æquilongis. *Corolla* cylindrica, lutea, 2 lin. longa. *Achænia* minuta, glabra. *Pappus* setosus, albus, mollis, 2 lin. longus.

British Central Africa. Mount Zomba, alt. 4000–6000 ft., *Whyte.*

631. **Senecio exsertiflorus,** *Baker* [Compositæ-Senecionideæ]; ad *S. nyikensem*, Baker, (vide infra) arcte accedit.

Suffrutex sarmentosus, subcarnosus, glaber. *Ramuli* infra sublignosi. *Folia* distincte petiolata, ovata, acuta, utrinque viridia, glabra, basi subcordata vel rotundata, inferiora 1½ poll. longa. *Capitula* discoidea, ad apices ramulorum laxe corymbosa, pedunculis divaricatis sæpe capitulis longioribus. *Involucrum* campanulatum, bracteis interioribus circiter 8 lanceolatis obtusis vel subacutis, exterioribus paucis parvis. *Flores* ad capitulum circiter 20, involucro duplo longiores. *Achænia* cylindrica, parva, glabra. *Pappus* albus, mollis, 3 lin. longus.

British Central Africa. Mount Zomba, alt. 4000–6000 ft., *Whyte.*

632. **Senecio nyikensis,** *Baker* [Compositæ-Senecionideæ]; ad *S. petitianum*, A. Rich., magis accedit.

Suffrutex sarmentosus, glaber. *Caules* graciles, lignosi, teretes. *Folia* distincte petiolata, integra, utrinque viridia, majora deltoidea, 2 poll. longa, basi truncata, superiora angustiora basi cuneata. *Capitula* discoidea, oblonga, ad apices ramulorum dense corymbosa. *Involucrum* campanulatum, 3 lin. longum, bracteis primariis circiter 8 lanceolatis glabris, basalibus paucis parvis. *Flores* cylindrici, circiter 20 ad capitulum. *Achænia* minuta, cylindrica, glabra. *Pappus* albus, 3 lin. longus.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 238.

633. **Senecio pergamentaceus,** *Baker* [Compositæ-Senecionideæ]; ad *S. bupleuroiden*, DC., magis accedit.

Herba perennis, erecta, glabra. *Caules* graciles, stricti, profunde sulcati. *Folia* sessilia, erecta, chartacea, utrinque viridia, glabra, inferiora ovato-lanceolata 5–6 poll. longa basi cordata, superiora sensim minora. *Capitula* heterogama, multiflora, ligulata, in paniculam laxam terminalem disposita, pedunculis elongatis gracillimis erectis. *Involucrum* campanulatum, 2 lin. longum, bracteis interioribus 7–8 glabris obtusis, exterioribus obsoletis vel 1–2 linearibus minutis. *Ligulæ* luteæ, 3 lin. longæ. *Achænia* cylindrica, glabra, 1 lin. longa. *Pappus* setosus, mollis, albus, 2–2½ lin. longus.

British Central Africa. Plains of Zomba, alt. 2500–3000 ft., *Whyte.*

634. **Senecio rectiramus**, *Baker* [Compositæ-Senecionideæ]; ad *S. sarmentosum*, O. Hoffm., magis accedit.

Suffrutex sarmentosus. *Caules* sublignosi, flexuosi, graciles, teretes, glabri. *Folia* distincte petiolata, cordato-ovata, integra, acuta, facie viridia glabra, dorso persistenter albo-incana, majora 1½–2 poll. longa, petiolo basi auriculato. *Capitula* heterogama, multiflora, in paniculas laxas disposita, paniculorum ramis primariis rectis patulis. *Involucrum* campanulatum, 2 lin. longum, bracteis interioribus circiter 15 rigidulis glabris lanceolatis, exterioribus paucis parvis albo-incanis. *Ligulæ* paucæ, parvæ, luteæ. *Achænia* cylindrica, parva, glabra. *Pappus* albus, mollis, 2 lin. longus.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 110.

635. **Senecio tabulicolus**, *Baker* [Compositæ-Senecionideæ]; ad *S. Steudelii*, Sch. Bip., magis accedit.

Herba perennis, erecta, parce albo-araneosa. *Caulis* gracilis, erectus, bipedalis, dimidio inferiore simplex, dimidio superiore laxe ramosus. *Folia* basalia lanceolata, semipedalia, subcoriacea, obscure crenata, in petiolum canaliculatum attenuata, facie glabra viridia, dorso tenuiter albo-incana; folia caulina linearia, parva, remota. *Capitula* multiflora, ligulata, heterogama, in paniculam amplam laxissimam corymbosam disposita. *Involucrum* campanulatum, 3 lin. longum, bracteis interioribus circiter 15 lanceolatis acutis leviter araneosis, exterioribus parvis linearibus. *Ligulæ* latæ, luteæ, 2 lin. longæ. *Achænia* cylindrica, glabra, 1 lin. longa. *Pappus* albus, mollis, setosus, 4 lin. longus.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 162.

636. **Berkheya echinopsoides**, *Baker* [Compositæ-Arctotideæ]; a speciebus reliquis tropico-africanis facile distinguitur foliis profunde pinnatifidis et involucri bracteis rigidis lanceolatis.

Herba perennis, erecta. *Caules* teretes, albo-araneosi, haud alati. *Folia* sessilia, ovato-lanceolata, 3–4 poll. longa, profunde pinnatifida, spinis paucis parvis stramineis marginata, facie viridia scabra, dorso dense persistenter albo-incana. *Capitula* homogama, plura, discoidea, terminalia, in paniculam latam corymbosam disposita. *Involucrum* campanulatum, 4 lin. longum, bracteis lanceolatis rigidis pungentibus, spinis copiosis stramineis marginatis. *Achænia* immatura glabra, ad basin attenuata. *Pappi* paleæ lanceolatæ, integræ, 2 lin. longæ.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 186.

637. **Berkheya parvifolia**, *Baker* [Compositæ-Arctotideæ]; ad *B. johnstonianam*, Britten, magis accedit.

Herba perennis. *Caules* ala dentata spinifera angusta præditi. *Folia* alterna, parva, remota, sessilia, lanceolata, dentata, spinis parvis stramineis marginata, facie spinulifera, dorso glabra. *Capitula* heterogama, magna, solitaria vel pauca corymbosa.

Involucrum campanulatum, 9 lin. longum, bracteis appressis lanceolatis rigidis pungentibus, spinis stramineis inæqualibus marginatis. *Ligulæ* lineares, luteæ, 9 lin. longæ. *Achænia* immatura cylindrica, glabra. *Pappus* parvus, paleaceus.

TROPICAL AFRICA. German East Africa: very common on hills north of Lake Nyasa and north of the Livingstone hills, *Rev. W. P. Johnson.* British Central Africa: between Kondowe and Karonga, *Whyte*, 357.

638. **Berkheya polyacantha,** *Baker* [Compositæ-Arctotideæ]; ad *B. spekeanam*, Oliv., magis accedit.

Herba perennis. *Caules* robusti, erecti, albo-lanosi, ad apicem foliati, foliis decurrentibus spinosis irregulariter alati. *Folia* alterna, sessilia, lanceolata, 2–3 poll. longa, pinnatifida, marginibus copiose spinosis, facie setoso-spinosa, dorso albo-lanata. *Capitula* pauca, magna, heterogama, corymbosa. *Involucrum* campanulatum, 1 poll. diam., bracteis multiserialibus appressis lanceolatis foliaceis, spinis copiosis stramineis pungentibus marginatis et terminatis. *Ligulæ* multæ, luteæ, 9 lin. longæ. *Achænia* immatura cylindrica, glabra. *Pappus* paleaceus, 3 lin. longus, paleis paucis integris lanceolatis.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 150.

639. **Gerbera Lasiopus,** *Baker* [Compositæ-Mutisiaceæ]; ad *G. piloselloiden*, Cass., magis accedit.

Herba perennis, collo radicis dense albo-lanosa. *Folia* pauca, omnia radicalia, longe petiolata, oblonga, integra, 2–3 poll. longa, facie viridia glabra, dorso purpureo tincta pubescentia. *Pedunculus* monocephalus, 6–10 poll. longus, gracilis, erectus, inferne parce, superne dense pubescens. *Involucrum* campanulatum, 6 lin. longum, bracteis pauciserialibus linearibus appressis dorso albo-pilosis. *Ligulæ* multæ, lanceolatæ, rubro-luteæ, 6 lin. longæ, dorso glabræ. *Florum disci* corollæ cylindricæ, 3 lin. longæ. *Achænia* immatura cylindrica, glabra, 1½ lin. longæ. *Pappus* setosus, copiosus, albidus, 3 lin. longus.

BRITISH CENTRAL AFRICA. Masuku plateau, alt. 6500–7000 ft., *Whyte.*

640. **Lobelia (Hemipogon) Buchanani,** *Baker* [Campanulaceæ-Lobelieæ]; ad *L. trullifoliam*, Hemsl., magis accedit.

Herba pusilla, annua, glabra. *Caules* decumbentes, ramosi, graciles, subpedales, apice ascendentes. *Folia* distincte petiolata, ovata, obtusa, 3–6 lin. longa, distincte crenata, membranacea, utrinque viridia. *Flores* pauci, ad apices ramorum laxe racemosi, pedicellis ascendentibus filiformibus 1–2 poll. longis. *Calycis* lobi lanceolati, 1 lin. longi. *Corolla* cærulea, tubo calyce duplo longiore, lobis obovatis 1 lin. longis. *Stamina* corollæ tubo æquilonga. *Capsula* obconica, 1½ lin. diam.

BRITISH CENTRAL AFRICA. Plateau of Mount Zomba, alt. 5000–6000 ft., *Whyte*; Nyasaland, *Buchanan*, 312 of 1891 collection.

641. **Lobelia (Hemipogon) intertexta,** *Baker* [Campanulaceæ-Lobelieæ]; ad *L. trullifoliam*, Hemsl., etiam accedit.

Herba annua. *Caules* gracillimi, erecti, subpedales, dense cæspitosi, haud alati, pilis sparsis patulis præditi. *Folia* membranacea, parce pilosa, utrinque viridia, inferiora breviter orbicularia 3 lin. longa profunde inciso-crenata, suprema sessilia linearia. *Flores* pauci, ad apices ramorum laxe racemosi, pedicellis 6–12 lin. longis basi foliis reductis stipatis. *Calycis* lobi subulati, $1\frac{1}{2}$ lin. longi. *Corolla* cærulea, fauce albo-cæruleo maculata, tubo 2 lin. longo, lobis obovatis tubo duplo brevioribus. *Stamina* e tubo haud exserta. *Capsula* obconica, $1\frac{1}{2}$ lin. diam.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte.*

642. **Lobelia (Hemipogon) nyikensis,** *Baker* [Campanulaceæ-Lobelieæ]; ad *L. acutidentem*, Hook. fil., magis accedit.

Herba perennis, glabra, e basi ramosissima. *Caules* subpedales, graciles, erecti vel diffusi, ad apicem laxe foliati. *Folia* alterna, distincte petiolata, subrotunda vel late ovata, 2–3 lin. longa et lata, profunde crenata, membranacea, utrinque viridia. *Flores* pauci, ad apices ramulorum laxe racemosi, pedicellis erecto-patentibus 12–18 lin. longis basi foliis reductis stipatis. *Calyx* $1\frac{1}{2}$–2 lin. longus, ad ovarium obconicum fissus, lobis linearibus. *Corolla* saturate cærulea, tubo cylindrico calyce duplo longiore, lobis labii inferioris 3 obovatis 1 lin. longis. *Antheræ* corollæ tubo protrusæ.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte.*

643. **Lobelia (Rhynchopetalum) squarrosa,** *Baker* [Campanulaceæ-Lobelieæ]; ad *L. gibberoam*, Hemsl., magis accedit.

Herba robusta, erecta. *Caulis* validus, pubescens, saltem 10-pedalis, ad apicem dense foliatus. *Folia* densa, ascendentia, sessilia, lanceolata, suprema $2\frac{1}{2}$–3 poll. longa, medio 6–8 lin. lata, crenulata, utrinque obscure viridia pubescentia, venis faciei inferioris haud elevatis. *Racemus* densissimus, cylindricus, bracteis lineari-subulatis squarrosis 12–18 lin. longis. *Calycis* lobi lanceolati, dorso pubescentes. *Corolla* expansa ignota. *Staminum* duorum antheræ barbatæ.

British Central Africa. Masuku plateau, alt. 6500–7000 ft., *Whyte*, 306.

644. **Cyphia nyasica,** *Baker* [Campanulaceæ-Cyphieæ]; ad *C. tortilem*, N. E. Br., magis accedit.

Herba glabra, gracilis. *Caules* volubiles. *Folia* alterna, remota, breviter petiolata, ovato-lanceolata, acuminata, 1–2 poll. longa, membranacea, serrata, utrinque viridia, glabra. *Flores* 1–3, aggregati, axillares, breviter pedicellati. *Calycis* lobi lanceolati, reflexi, $1\frac{1}{2}$ lin. longi. *Petala* lanceolata, 9 lin. longa, basi intus pubescentia. *Capsula* globosa, glabra, 3 lin. diam., dimidio superiore libera. *Stylus* brevis, indivisus, curvatus, stigmate capitato.

British Central Africa. Between Kondowe and Karonga, *Whyte.*

645. **Lightfootia capitata,** *Baker* [Campanulaceæ-Campanuleæ]; ad *L. glomeratam*, Engl., magis accedit.

Herba perennis, erecta, vix pedalis, superne ramosissima. *Rami* graciles, ascendentes, pilis subtilibus patulis vestiti. *Folia* sessilia, lanceolata, 9–12 lin. longa, utrinque pilosa, marginibus conspicue crispato-undulatis. *Flores* in capitulum terminale globosum aggregati, bracteis rigidulis lanceolatis. *Calyx* hispidus, 2 lin. longus, profunde fissus, lobis lanceolatis primum erectis demum patulis. *Corolla* lilacina, calyce paulo longior. *Capsula* oblonga, dimidio superiore libera.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000-7000 ft., *Whyte.*

646. **Faroa axillaris,** *Baker* [Gentianeæ]; ad *F. graveolentem*, Baker, magis accedit.

Herba annua, glabra. *Caulis* quadrangularis, erectus, semipedalis, ramosus. *Folia* opposita, patula, sessilia, membranacea, inferiora oblonga, trinervata, 15–18 lin. longa, superiora lanceolata. *Flores* in glomerulos globosos sessiles axillares aggregati. *Sepala* oblanceolata, obtusa, 1 lin. longa. *Perianthium* stramineum, tubo oblongo 1 lin. longo, segmentis ovatis patulis tubo duplo brevioribus. *Stamina* perianthii segmentis æquilonga. *Capsula* in tubo inclusa.

BRITISH CENTRAL AFRICA. Masuku plateau, alt. 6500-7000 ft., *Whyte.*

647. **Canscora ramosissima,** *Baker* [Gentianeæ]; ad *C. decussatam*, Schultes, accedit.

Herba nana, glabra, e basi ramosissima. *Caules* acute tetragoni, haud alati, ramis crebris ascendentibus. *Folia* sessilia, lanceolata, inferiora 6–8 lin. longa. *Flores* pauci, ad apices ramorum racemosi, foliis valde reductis bracteati, pedicellis brevissimis erecto-patentibus. *Sepala* ovata, viridia, 2 lin. longa, dorso anguste alata. *Corollæ* tubus e calyce breviter exsertus, lobis parvis. *Stamina* inclusa. *Capsula* oblonga, 2 lin. longa.

BRITISH CENTRAL AFRICA. Fort Hill, Nyasa-Tanganyika plateau, alt. 3500–4000 ft., *Whyte.*

648. **Swertia pleurogynoides,** *Baker* [Gentianeæ]; habitu omnino *Pleurogynæ rotatæ*, Griseb., europeæ, sed petalis supra basin foveolis binis præditis.

Herba annua, glabra. *Caules* erecti, graciles, subpedales, superne ramosi. *Folia* remota, paucijuga, sessilia, anguste linearia, patula, 12–15 lin. longa. *Cymæ* multæ, paucifloræ, terminales et axillares, in paniculam angustam laxam elongatam dispositæ, pedicellis brevibus erectis. *Sepala* linearia, 3–4 lin. longa. *Petala* sublibera, lanceolata, alba, supra basin foveolis binis parvis viridibus prædita. *Stamina* petalis duplo breviora, antheris parvis globosis. *Capsula* demum petalis æquilonga.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte.*

649. **Swertia porphyrantha**, *Baker* [Gentianeæ]; ad *S. Lastii*, Engl., magis accedit.

Herba annua, glabra. *Caules* erecti, graciles, subpedales, teretes, dimidio superiore valde ramosi. *Folia* remota, opposita, subsessilia, ovata, parva, crassa, utrinque viridia. *Cymæ* in paniculam amplam corymbosam aggregatæ, pedicellis erectis quam flore sæpe longioribus. *Sepala* crassa, viridia, oblonga vel oblanceolato-spathulata, obtusa, 2 lin. longa. *Corolla* 4 lin. longa, tubo brevi, lobis latis obtusis. *Stamina* corolla duplo breviora, antheris oblongis parvis. *Capsula* oblonga, chartacea, bivalvis, petalis persistentibus demum longior.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 147.

650. **Tecoma nyikensis**, *Baker* [Bignoniaceæ]; ad *T. shirensem*, Baker, arcte accedit.

Frutex erectus, glaber. *Ramuli* lignosi, graciles. *Folia* distincte petiolata, imparipinnata, foliolis 9–11 ovatis acutis, superioribus 9–16 lin. longis, basi cuneatis indistincte crenulatis utrinque viridibus facie glabris dorso leviter pubescentibus. *Racemi* laxi, pauciflori, terminales, pedicellis ascendentibus 3–4 lin. longis medio bracteolis unijugis parvis linearibus præditis. *Calyx* 5 lin. longus, leviter pubescens, dentibus ovato-lanceolatis tubo campanulato paulo brevioribus. *Corollæ* tubus infundibularis, curvatus, 1 poll. longus, lobis latis tubo duplo brevioribus. *Stamina* longiora et stylus corolla paulo longiores; antheræ 2 lin. longæ, loculis basi segregatis.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 112.

651. **Selago thyrsoidea**, *Baker* [Selagineæ]; ad *S. whyteanam*, Rolfe, accedit.

Herba perennis, e basi ramosissima. *Radix* magna, lignosa, fusiformis. *Caules* plures, erecti, simplices, semipedales, pubescentes, ad apicem crebre foliati. *Folia* conferta, sessilia, ascendentia, anguste linearia, uninervia, dorso pubescentia, siccitate nigrescentia. *Flores* perplurimi, in paniculam densam thyrsoideam dispositi, ramulis pubescentibus. *Calyx* campanulatus, $\frac{3}{4}$ lin. longus, dense pubescens, ad basin fissus, lobis linearibus. *Corollæ* tubus calyci æquilongus; limbus expansus 2 lin. diam., lobis obovatis obtusis 1 lin. longis, superioribus basi connatis. *Stamina* longiora limbo æquilonga.

British Central Africa. Nyika plateau, alt. 7000 ft., *Whyte*, 144.

652. **Clerodendron (Cyclonema) macrostachyum**, *Baker* [Verbenaceæ]; ad *C. myricoiden*, R. Br., magis accedit.

Suffrutex, ramis robustis sublignosis erectis glabris. *Folia* sessilia, opposita, oblanceolato-oblonga, 4–6 poll. longa, dimidio superiore crenata, e medio ad basin sensim attenuata, penninervia, facie viridia, dorso pubescentia. *Cymæ* densæ, multifloræ, sessiles, in paniculam cylindricam 6–9 poll. longam aggregatæ, bracteis

primariis linearibus parvis foliaceis, pedicellis pubescentibus. *Calyx* pubescens, tubo campanulato, lobis inæqualibus ovatis vel oblongis demum 3 lin. longis. *Corolla* et *stamina* ignotæ. *Ovarium* globosum.

BRITISH CENTRAL AFRICA. Mount Zomba, alt. 2500–3500 ft., *Whyte.*

653. **Clerodendron (Euclerodendron) syringæfolium,** *Baker* [Verbenaceæ]; ad *C. glabrum*, E. Meyer, magis accedit.

Frutex, ramis lignosis angulatis obscure pubescentibus. *Folia* opposita, longe petiolata (petiolorum basibus induratis persistentibus), ovata, cordata, cuspidata, 2–3 poll. longa, integra, utrinque viridia, leviter pubescentia, dorso crebre glandulis rubris punctata. *Cymæ* in paniculam densam terminalem congestæ, pedicellis brevibus leviter pubescentibus. *Calyx* glaber, 3 lin. longus, tubo campanulato, dentibus lanceolatis acuminatis. *Corollæ* tubus cylindricus, 5–6 lin. longus; limbus expansus 3 lin. diam., lobis orbicularibus. *Stamina* segmentis triplo longiora.

BRITISH CENTRAL AFRICA. Between Mpata and the Nyasa-Tanganyika plateau, alt. 2000–3000 ft., *Whyte.*

654. **Acrocephalus oligocephalus,** *Baker* [Labiatæ]; ad *A. cylindraceum*, Oliv., accedit.

Herba perennis. *Caules* erecti, ramosi, graciles, pedales vel sesquipedales, obscure pilosi, parce foliati. *Folia* breviter petiolata, lanceolata, 1–1½ poll. longa, crenata, ad basin attenuata, utrinque viridia, pilosa. *Capitula* parva, globosa. solitaria, foliis 2–3 reductis basi bracteata, bracteis floralibus orbiculari-cuneatis 1½–2 lin. latis. *Calyx* 1½ lin. longus, labiis obtusis. *Corollæ* tubus calyci æquilongus, labiis parvis. *Stamina* e labio inferiore vix exserta.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte*; Shire Highlands, *Buchanan*, 493 of 1891 collection.

655. **Acrocephalus venosus,** *Baker* [Labiatæ]; ad *A. lilacinum*, Oliv., accedit.

Herba perennis, erecta. *Caules* graciles, pilosi, remote foliati, bipedales. *Folia* sessilia, lanceolata, erecto-patentia, 2–3 poll. longa, integra vel obscure crenata, utrinque viridia pilosa, dorso crebre nigro-punctata, venis faciei inferioris elevatis. *Capitula* parva, dense corymbosa, globosa vel oblonga, basi foliis ovatis sæpissime coloratis prædita, bracteis floralibus rotundato-cuneatis pilosis 1½–2 lin. longis et latis. *Calyx* 2 lin. longus, labiis elongatis obtusis. *Corollæ* tubus e calyce breviter exsertus, labiis parvis.

BRITISH CENTRAL AFRICA. Manganja hills, alt. 3000 ft., *Kirk*; Shire highlands, *Buchanan*, 266 of 1891 collection; North Nyasaland, *Whyte.*

656. **Æolanthus nyikensis,** *Baker* [Labiatæ]; ad *Æ. Nyassæ*, Gürke, arcte accedit.

Suffrutex basi lignosus, ramulis ascendentibus subtiliter pilosis. *Folia* breviter petiolata, suborbicularia, 1–1½ poll. longa, profunde

inciso-crenata, basi integra cuneata, utrinque viridia pubescentia. *Spicæ* densæ, 1–1½ poll. longæ, pedunculatæ, in paniculam amplam dispositæ; bracteæ late ovatæ, 2–3 lin. longæ, acutæ, membranaceæ, persistentes, pubescentes, purpureæ. *Calyx* brevissimus, membranaceus, labiis ovatis. *Corolla* 4 lin. longa, tubo e calyce longe exserto, labio superiore concavo, inferiore suborbiculari profunde lobato. *Stamina* corollæ æquilonga.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 6000–7000 ft., *Whyte*, 119.

657. **Æolanthus salicifolius**, *Baker* [Labiatæ]; ad *Æ. ambustum*, Oliv., magis accedit.

Herba perennis. *Caules* breves, decumbentes, graciles, teretes, dense pubescentes. *Folia* sessilia, linearia, ascendentia, subcoriacea, integra, glabra, 1–1½ poll. longa. *Spicæ* densæ, 1–3 poll. longæ, in paniculam brevem terminalem aggregatæ; bracteæ lineares, pilosæ, calyci æquilongæ. *Calyx* 2 lin. longus, pubescens, tubo cylindrico supra basin induratam persistentem circumscisso, labiis brevibus obtusis. *Corollæ* tubus calyci æquilongus, labio superiore parvo oblongo-naviculari, labio inferiore parvo orbiculari trilobato. *Stamina* in tubo inclusa.

BRITISH CENTRAL AFRICA. Nyika plateau, 6000–7000 ft., *Whyte*, 107.

658. **Pycnostachys leptophylla**, *Baker* [Labiatæ]; ad *P. urticifoliam*, Hook., magis accedit.

Herba erecta, ramosa. *Caules* acute tetragoni, graciles, parce ramosi, remote foliati. *Folia* paucijuga, petiolata, ovata, acuta, crenata, membranacea, inferiora 2 poll. longa, utrinque viridia, glabra. *Spicæ* solitariæ vel paucæ, cylindricæ, terminales, 2–3 poll. longæ, laterales breviores. *Calyx* campanulatus, tubo brevi, dentibus rigidis setaceis 2 lin. longis. *Corolla* cærulea, 6 lin. longa, tubo reflexo sursum infundibulari, labio superiore parvo, inferiore concavo unguiculato 2 lin. longo. *Stamina* haud exserta.

BRITISH CENTRAL AFRICA. Between Kondowe and Karonga, *Whyte*; Shire highlands, *Buchanan*, 873 of 1891 collection.

659. **Pycnostachys remotifolia**, *Baker* [Labiatæ]; ad *P. Schweinfurthii*, Briquet, magis accedit.

Herba perennis, erecta. *Caules* graciles, glabri, ramosi, remote foliati. *Folia* opposita, paucijuga, subsessilia, lanceolata, acuminata, 3–4 poll. longa, remote serrata, ad basin attenuata, utrinque viridia glabra. *Spicæ* plures, densæ, oblongæ, 1–1½ poll. longæ, in paniculam laxam dispositæ. *Calycis* tubus brevis, dentibus setaceis rigidis 3 lin. longis. *Corolla* cærulea, tubo elongato reflexo, labio inferiore concavo 4 lin. longo, labio superiore parvo. *Stamina* haud exserta.

BRITISH CENTRAL AFRICA. Fort Hill, Nyasa-Tanganyika plateau, alt. 3500–4000 ft., *Whyte*.

660. **Pycnostachys sphærocephala,** *Baker* [Labiatæ]; inter *P. urticifoliam,* Hook., et *P. reticulatam,* Benth., medium tenens.

Herba perennis. Caulis erectus, ramosus, breviter pubescens. *Folia* subsessilia, oblongo-lanceolata, 3–4 poll. longa, acuta, basi attenuata, crebre inciso-crenata, facie viridia scabra, dorso persistenter griseo-incana. *Flores* ad apices ramorum in glomerulos globosos congesti, floribus inferioribus deflexis. *Calyx* floriferus tubo brevis, dentibus rigidis lanceolatis 1-1½ lin. longis. *Corolla* cærulea, 8–9 lin. longa, tubo reflexo dimidio superiore infundibulari, labiis magnis, inferiore profunde trilobato. *Stamina* inclusa.

BRITISH CENTRAL AFRICA. Nyika plateau, alt. 5000-6000 ft., *Whyte,* 139.

661. **Scutellaria Livingstonei,** *Baker* [Labiatæ]; ad *S. peregrinam,* Linn., accedit.

Herba perennis. *Caules* cæspitosi, erecti, pedales, dense pubescentes. *Folia* paucijuga, breviter petiolata, ovata, obtusa, 9–12 lin. longa, subintegra, utrinque viridia parce pilosa. *Flores* in racemum laxum terminalem dispositi, pedicellis brevibus pubescentibus, bracteis parvis oblongis foliaceis. *Calyx* campanulatus, pubescens, 1½ lin. longus, labiis brevibus valde obtusis. *Corolla* atropurpurea, pubescens, 7–8 lin. longa, tubo recto subcylindrico, labio superiore oblongo-naviculari tubo duplo breviore, labio inferiore suborbiculari superiori æquilongo. *Stamina* ac *stylus* corollæ æquilongi.

BRITISH CENTRAL AFRICA. Manganja hills, *Kirk;* Shire highlands, *Buchanan,* 144 of 1891 collection; Blantyre, *L. Scott;* Mount Malosa, alt. 4000 ft., *Whyte;* without locality, *Livingstone.*

First known to us from a fragment in Dr. Livingstone's pocket-book, received after his death in 1874.

662. **Achyrospermum cryptanthum,** *Baker* [Labiatæ]; ad *A. africanum,* Hook. fil., accedit.

Frutex ramulis lignosis teretibus dense pubescentibus. *Folia* opposita, brevissime petiolata, ovata, 3–4 poll. longa, acuta, crenata, basi rotundata vel cuneata, utrinque viridia, pilosa. *Cymæ* sessiles, umbellatæ, in paniculam densam cylindricam 5–6 poll. longam aggregatæ; bracteæ late ovatæ, inferiores 5–6 lin. latæ; pedicelli pubescentes, calyce breviores. *Calyx* demum 4 lin. longus, tubo infundibulari, dentibus ovatis subæqualibus 1 lin. longis. *Corolla* pubescens, 6 lin. longa, tubo infundibulari, labio superiore parvo oblongo-naviculari, inferiore orbiculari. *Stamina stylusque* e labio superiore breviter exserti.

BRITISH CENTRAL AFRICA. Masuku plateau, 6500–7000 ft., *Whyte.*

663. **Leucas masukuensis,** *Baker* [Labiatæ]; ad *L. myriantham,* Baker, magis accedit.

Herba perennis. *Caules* graciles, ramosi, erecti, pedales, dense pubescentes. *Folia* brevissime petiolata, ovata, acuta, 5–6 lin. longa, utrinque viridia, tenuiter pilosa, dorso crebre nigro-punctata.

Glomeruli multi, globosi, in paniculam cylindricam terminalem aggregati, bracteis primariis parvis foliaceis, pedicellis brevissimis. *Calyx* 2 lin. longus, pubescens, dentibus æquilongis acuminatis. *Corolla* alba, tubo calyci æquilongo, labiis parvis. *Stamina* e labio superiore haud exserta.

British Central Africa. Masuku plateau, alt. 6500–7000 ft., *Whyte.*

664. **Leucas megasphæra**, *Baker* [Labiatæ]; ad *L. grandem*, Vatke, magis accedit.

Herba perennis. *Caules* graciles, tetragoni, pubescentes, remote foliati. *Folia* breviter petiolata, lineari-oblonga, 1–3 poll. longa, leviter crenata, utrinque longe pilosa. *Glomeruli* 1–2, magni, multiflori, foliis magnis bracteati, pedicellis brevibus pilosis, bracteis floralibus linearibus dense pilosis. *Calyx* 7 lin. longus, dense pilosus, ore obliquo, labio inferiore producto, dentibus superioribus linearibus, inferioribus parvis ovato-acuminatis. *Corolla* albida, tubo calyci æquilongo, labio superiore 4 lin. longo dense albo-piloso, inferiore deflexo trilobato. *Stamina* e labio superiore haud exserta.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., *Whyte.*

665. **Leucas myriantha,** *Baker* [Labiatæ]; a speciebus reliquis recedit ore calycis æquali, glomerulis pluribus approximatis, bracteis primariis parvis.

Herba perennis. *Caules* erecti, pubescentes, pedales vel sesquipedales, simplices vel furcati. *Folia* breviter petiolata, ovata, acuta, 1–1½ poll. longa, integra, utrinque viridia, tenuiter pilosa, dorso crebre nigro-punctata. *Glomeruli* multi, in paniculam cylindricam semipedalem aggregati, bracteis primariis parvis foliaceis, bracteis floralibus lanceolatis pilosis calyci æquilongis, pedicellis brevibus. *Calyx* 4 lin. longus, dense pubescens, tubo brevi, ore haud obliquo, dentibus setaceis æquilongis. *Corollæ* tubus calyci æquilongus, labio superiore parvo oblongo, inferiore parvo deflexo trilobato. *Stamina* e labio superiore haud exserto.

British Central Africa. Nyika plateau, alt. 6000–7000 ft., Whyte, 178, 214; between Mpata and the commencement of the Nyasa-Tanganyika plateau, 2000–3000 ft., *Whyte.*

666. **Tinnea physaloides,** *Baker* [Labiatæ]; ad *T. æthiopicam*, Kotschy et Peyr., accedit.

Frutex ramulis gracilibus lignosis dense breviter pilosis. *Folia* opposita, petiolata, ovata, acuta, 2–3 poll. longa, basi late rotundata, facie saturate viridia subglabra, dorso pallide viridia pubescentia. *Flores* in racemum laxum terminalem dispositi, pedicellis pubescentibus 2–4 lin. longis. *Calyx* pubescens, valde accrescens, primum oblongus, 7–8 lin. longus, demum vesiculosus, membranaceus, basi cordatus, 12–15 lin. longus, labiis brevibus rotundatis. *Corolla* pubescens, 1 poll. longa. *Stamina* inclusa.

British Central Africa. Masuku plateau, alt. 6500–7000 ft., *Whyte*, 289.

667. **Eriospermum tulbaghioides**, *Baker* [Liliaceæ]; a speciebus reliquis recēdit filamentis quadratis emarginatis.

Tuber globosum, 2 poll. diam., cortice sordide brunneo. *Folium* post scapum productum, longe petiolatum, lineari-oblongum, 5–6 poll. longum, 15 lin. latum, subcoriaceum, glabrum, apice deltoideum. *Pedunculus* gracilis, subpedalis. *Racemus* oblongus, subdensus, pedicellis erecto-patentibus 3–4 lin. longis, bracteis deltoideis minutis. *Perianthium* viride, 2 lin. longum, segmentis lineari-oblongis. *Stamina* perianthio triplo breviora, filamentis quadratis emarginatis rubris, antheris oblongis parvis.

SOUTH AFRICA. Cultivated at Kew from tubers sent by Mr. Charles Howlett, of Uitenhage, in 1895.

668. **Ornithogalum subspicatum**, *Baker* [Liliaceæ]. This name is substituted for that of *Ornithogalum Galpini*, Baker (*Flora Capensis*, vi. 536), which had already been used for another species (*l.c.* 516).

DCXII.—FIJI INDIA RUBBER.

In the *Kew Report* for 1877, p. 31, it is stated that a specimen of native caoutchouc had been received from Sir Arthur Gordon (now Lord Stanmore), Governor of Fiji. This is still in the Kew Museum. It was favourably reported upon at the time and described as a "strong, elastic, pure rubber of the same character as the higher grades of African rubber. If free from water admixture and impurity the value would be 1*s*. 6*d*. per pound." This was twenty-one years ago. At the present time the price would probably be 2*s*. or 2*s*. 6*d*. per pound. After so promising a beginning it was hoped that a successful rubber industry would be established in the Fiji Archipelago. So far, however, this expectation has not been realized.

It was stated that the tree from which the rubber was obtained "was very common in the islands." In 1878 Mr. John Horne, F.L.S., then Director of the Botanic Gardens at Mauritius, visited Fiji and paid particular attention to their economic resources.

A report on the Caoutchouc or India rubber plants is published as an Appendix to his "*Year in Fiji*" (London, Stanford, 1881), pp. 195-202.

The Fijian name for caoutchouc is "drega," and the term "drega kau" is generally applied to all trees that have a milky juice.

Mr. Horne found a species of *Tabernæmontana* (since named *T. Thurstoni*, Baker, *Journ. Linn. Soc.* XX., 368), with white flower and a reddish-yellow berry about ½ inch diameter. "When wounded a thin milk-white juice exudes which yields a small quantity of caoutchouc." Locally this is known as "Kau Drega," or "Talotalo." Mr. R. L. Holmes (in the enclosure to the Governor's despatch of the 15th April, 1898) speaks of it as "decidedly our best rubber-yielding tree." He adds: "It grows to a large size. Those that I saw were up to 18 inches or 2 feet through at the base. It is found scattered in the forest on the hills and valleys, but is not gregarious." The specimen of rubber

from this tree recently received from Fiji was hard and gutta-like and without elasticity. In the condition in which it reached this country it was of little or no commercial value.

The most promising india rubber plant met with by Mr. Horne was *Alstonia plumosa*, Labill.; of this possibly, *A. villosa*, Seemann, is a hairy form. The account given of this tree is as follows :—

"The Fijian name" says Mr. Horne "is 'Drega quruquru.' They collect the juice in their mouths, which makes the caoutchouc as adhesive as glue, and of about the consistency and colour of putty. To get the juice, the Fijians break off the leaves from the branches, and collect it as it flows from the petioles and the wounds on the branches caused by the breaking off of the leaves. The branches are next broken off the trees, and each branch is broken up into pieces from 6 inches to a foot long.

"As fast as the pieces are broken, first one end of them is placed in the mouth, then the other, till the mouth is full of crude caoutchouc. Several mouthfuls are collected together and squeezed into a round mass or ball. This method of collecting the juice, with the ruthless manner of breaking the trees, somewhat surprised me when I first saw it done. Since then repeated trials in all parts of Fiji have convinced me that the sap or juice does not flow freely by wounding the bark on the trunk of the tree in any way whatever. This is the reason for breaking the branches. The youngest branches of the tree contain most juice. When the old or firm-wooded branches are broken very little sap flows from them. When the young branches are broken the sap flows rapidly for a few seconds. It soon coagulates when exposed to the air, and the wound has to be freshened to cause the sap to flow anew. When the branches are broken into pieces of about a foot in length the juice flows from the ends and the pieces are drained almost entirely. A little more may be obtained by breaking the pieces in the middle, but very little. The juice flows from between the bark and the wood, and from the pith, or from between the pith and the wood.

"The coagulated juice would seem to have some attraction for the juice in a semi-liquid condition. If a portion of the coagulated juice be applied to the semi-liquid juice adhering to the ends of a broken branch, the slightest touch makes them join firmly. The adhesion is so perfect that the portions will not be separated, and a slight pull takes the semi-coagulated juice clean out of the many fissures or cracks in the ends of the broken branch. To obtain crude caoutchouc from this tree the juice has simply to be collected and worked with the fingers. It requires no other preparation. The juice congeals so rapidly that when collected in dry weather it requires little if any drying. The caoutchouc may be sent to market in balls, or it may be pressed in moulds into long thin pieces, one or two inches broad and an inch in thickness (more or less) as may be required. Samples of it have been sent to England, and the quality was highly valued."

Nothing further was done in regard to Fiji rubber until last year, when, in response to an inquiry from Kew, efforts were made to obtain botanical specimens of all the plants yielding a milky juice.

This was followed by the receipt of two samples of rubber forwarded by the present Governor, Sir George O'Brien. The first samples proved entirely valueless. The second, received in March, 1898, were more promising.

Alstonia plumosa is known in Viti Levu as "Sarua." It is described as abounding in the forests and if carefully treated might prove a useful rubber-producing plant. Mr. Joske, the Commissioner for Colo North, states "the leaves are large and glossy: the gum is obtained from the petiole or stalk. As soon as the leaf is broken a thick milky juice exudes, which when exposed to the heat of the sun for a little while congeals. It is then detached with a bit of bamboo or knife and the different particles are pressed together into balls. That is the way it is produced when required as an article of commerce. It is also chewed by children as a pastime and made into plastic balls with which to play."

Mr. Joske adds, "I remember twenty years ago that it was collected on both of the above islands [Viti Levu and Vanua Levu] as an article of commerce. If I recollect rightly, it even then fetched a good price in the European markets. The export of it fell off owing to the difficulty of getting the natives to continue steadily at the industry, and owing to the fact also that settlers hoped to do better with what they then considered more important articles such as cotton, sugar and coffee."

It is possible that under the stimulus of higher prices rubber gathering in Fiji may be revived. It is evident, however, that the preparation has almost become a lost art, for the specimen lately received from Sir George O'Brien was "soft and viscid on the outside, with little or no elasticity, and practically without value."

A later specimen, received in June last, was not so viscid, but it gradually became hard and inelastic. Mr. Holmes confirms Mr. Horne that no milk is obtainable from the stem.

With the above was enclosed a sample of rubber from a tree known as "Baka" (*Ficus obliqua*, Forst. f.). According to Mr. Joske, this "yields quantities of rubber." Further, "it is used by the natives of the interior as birdlime with which at certain seasons of the year they catch wild pigeons; it is very easily procured. Incisions are made in the bark and underneath are placed bamboos which receive the sap as it pours out. It is coagulated by means of heat, ... the natives say they could get immense quantities of this without much trouble. Were it discovered that the rubber was of commercial value it would prove an estimable boon to the natives of these islands."

Although the specimens of "Baka" rubber received at Kew had not been sufficiently coagulated, it was regarded by Messrs. Hecht, Levis, and Kahn as suitable for mixing purposes, and its value to-day was placed at 1*s*. to 1*s*. 3*d*. per pound.

A substance obtained from the "Ban" tree, possibly a member of the *Sapotaceæ*, but, in the absence of flowers, otherwise indeterminable, was slightly elastic and might command a sale at 10*d*. to 1*s*. per pound.

Other specimens, obtained from the "Wasalili" (*Carruthersia scandens*, Seem.) and the "Malawaci" (*Trophis anthropophagorum*, Seem.), were entirely deficient of elastic properties and reported to be of no commercial value.

DCXIII.—SAN JOSE SCALE.

A plant-pest known under the above name has recently attracted a good deal of attention in the United States and Canada, as well as in this country and on the Continent. A special Bulletin has been issued on the subject by the United States Department of Agriculture.* The original home of this scale (*Aspidiotus perniciosus*) is at present unknown. It was observed in an epidemic form in the San Jose Valley in California, about 1870. Since then it has rapidly spread in every direction in the United States. The seriousness of its attacks may be gathered from the following extract :—

"There is perhaps, no insect capable of causing greater damage to fruit interests in the United States, or perhaps the world, than the San Jose, or pernicious scale. It is not striking in appearance, and might often remain unrecognized, or at least misunderstood, and yet so steadily and relentlessly does it spread over practically all deciduous fruit trees—trunk, limbs, foliage, and fruit—that it is only a question of two or three years before the death of the plant attacked is brought about, and the possibility of injury, which, from experience with other scale enemies of deciduous plants, might be easily ignored or thought insignificant, is soon startlingly demonstrated. Its importance from an economic standpoint, is vastly increased by the ease with which it is distributed over wide districts through the agency of nursery stock and the marketing of fruit, and the extreme difficulty of exterminating it where once introduced, presenting, as it does in the last regard, difficulties not found with any other scale insect." (l.c. pp. 9–10.)

Aspidiotus perniciosus belongs to the sub-family Diaspinæ of the Coccidæ. It is a small soft insect which secretes a scale separate from itself much like the shell of an oyster. This scale is very minute, round, flattened, and in the case of the male is "grayish, hardly black, with a light dot and ring."

The illustrations reproduced in the *Gardeners' Chronicle* (Feb. 12, 1898, p. 103, figs. 37–40) will afford some idea of the appearance of the insect. In fig. 37 it is on a Californian pear and of the natural size.

Outside the United States the insect is known to occur in Australia, Chile and Hawaii. It is now spread throughout the States of California, Oregon and Washington, reaching British Columbia during the last few years. It has extended southward to Nevada, Arizona and New Mexico. In the Eastern States its occurrence has in many cases been traced to two large New Jersey nurseries "from which infested plants had unwittingly been sent out for certainly six or seven years." The Southern States, such as Louisiana and Florida, appear also to be infected, but so far not to the same extent as the Western States. Altogether "the San Jose scale has in a few years gained a foothold in no less than fourteen States east of the Rocky Mountains. Its latitudinal range extends from 28° S. lat., to 50° N. lat.

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* The San Jose Scale: its occurrence in the United States, with a full account of its life history and the remedies to be used against it. By L. O. Howard and C. L. Marlatt. Bulletin No. 3. New Series. United States Department of Agriculture. Division of Entomology. With a map and numerous woodcuts. [Washington. Government Printing Office. 1896.]

As regards the plants attacked, it is stated that "practically all deciduous fruit trees are subject" to its attacks; also "many shade trees and ornamental shrubs. The pear, peach, plum, apple and cherry are almost equally liable to injury"; also currant and gooseberry bushes.

All parts of the plants become eventually covered, giving them the appearance of a "grayish, very slightly roughened, scurfy deposit."

Various methods are suggested as remedies and preventives. A lime-sulphur wash is said to be used during the dormant season as a winter application; a resin wash both as a winter and summer wash, chiefly the former; while a kerosine emulsion is used in the summer only. In addition, there is the hydrocyanic gas treatment applied to nursery stock. In all cases of recent attack, and this is of special interest in this country, "the affected stock should be promptly uprooted and burned. No measure is so sure as this, and the danger of spreading is so great that this course seems fully warranted."

As precautionary measures the United States Department of Agriculture suggest the following :—

"No orchardist should admit a single young fruit tree or a single cutting from a distance into his orchard without first carefully examining it and satisfying himself conclusively that it does not carry a single specimen of the San Jose scale; he should insist also on a guarantee from the nurseryman of such freedom. In addition, no fruit should be brought upon the premises without previous careful inspection." (l.c. p. 66.)

As was naturally to be expected, all European countries receiving vegetable production, such as fruit, &c., from the United States have been keenly anxious not to introduce so serious a pest as the San Jose scale into their nurseries or orchards.

As far as this country is concerned, according to an extract published in the *Gardeners' Chronicle* of March 19, 1898, "Mr. Newstead, an authority on scale insects, is satisfied that the insect has not yet established itself in this country, either upon fruit trees or cultivated plants of any kind, whether grown in the open air or under glass, or upon indigenous plants." How long this immunity will last it is difficult to say.

In the meantime, according to a letter to the *Times*, from Berlin, dated February 3, an order has been issued by the German Government to control, by careful inspection, the importation of all fresh fruit from America. When the same is discovered to be infected with the San Jose scale it is at once refused. The importation of windfalls, packing material and plants is entirely forbidden.

La Semaine Horticole for May 7, states, however, that "L'entrée des fruits d'Amerique est prohibée en Allemagne, au moins temporairement."

According to the *Revue Horticole* for May 16, "Le gouvernement hollandais a interdit pour quatre mois l'entrée des arbres et arbustes, fruits frais ou secs, de provénance americaine. . . . . De son côté, le conseil fédéral suisse vient de prononcer la même interdiction."

The contiguity of the Dominion of Canada to the United States, and the consequent greater danger of infection with which it is threatened, has led to the passing of a law by the Canadian Parliament prohibiting the entry of all nursery stock from the States. It regards an effective inspection of such stock as impossible. Hence the prohibition is absolute as in the case of Germany.

The following correspondence, communicated to Kew by the Secretary of State for the Colonies, indicates the strong position taken up by the Dominion Government in endeavouring to deal with the subject :—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

Downing Street,
May 6, 1898.

SIR,

I AM directed by the Secretary of State for the Colonies to transmit to you, for your information, a copy of a despatch which has been received from the Governor-General of Canada with its enclosures, on the subject of the Canadian law prohibiting the importation of nursery stock from the United States entitled the "San Jose Scale Act."

I am, &c.,
(Signed) EDWARD WINGFIELD.

The Director,
Royal Gardens, Kew.

LORD ABERDEEN to SIR JULIAN PAUNCEFOTE.

Ottawa,
April 9, 1898.

SIR,

WITH reference to Your Excellency's despatch No. 42 of the 28th ultimo on the subject of an Act recently passed by the Parliament of Canada, prohibiting the importation of nursery stock from the United States, I have the honour to enclose herewith copy of an approved minute of the Privy Council explaining the considerations which led to the enactment of this measure and representing that present circumstances do not admit of any modification of its provisions.

I have, &c.,
(Signed) ABERDEEN.

His Excellency Sir Julian Pauncefote, G.C.B.,
&c., &c.

(ENCLOSURE.)

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by His Excellency on the 7th April, 1898.

The Committee of the Privy Council, have had under consideration a paraphrase of a despatch Secret of March 28, 1898, and a despatch dated March 28, 1898, from Sir Julian Pauncefote, Her Majesty's Ambassador to the United States, intimating that some modification in the recent law prohibiting nursery stock

from the United States is urged by the State Department of that country, owing to the disastrous effect on the interests of American dealers whose contracts are to be filled.

The Minister of Agriculture, to whom the said despatches were referred, states that the very serious depredation caused by the ravages of the San Jose scale in the United States of America, induced Canada, in self protection, to take immediate and extreme measures to prevent the introduction of the pest into the Dominion.

The Minister further states that 32 of the States of the Union as well as the District of Columbia are now known to be infected with this pest, and that so alarmed are the authorities of the different States at the increase of this insect, which is acknowledged to be by far the worst enemy of trees which has ever been studied by entomologists, that many of the States are now for this reason actually passing legislation as drastic as possible in their circumstances, with the object of preventing the shipment of infested stock from State to State.

The Minister submits that, in the opinion of all entomologists who have studied the subject, inspection is insufficient; the Dominion entomologist claims that thorough inspection is impossible.

The Minister observes that the following sentence appears in the latest publication on the subject by the United States' Entomologist, Bulletin 12, New Series, United States Department of Agriculture, page 25:

"The insufficiency of inspection certificates has been insisted upon again and again."

The Minister further states that the San Jose scale has been found at a few localities in the province of Ontario, in one of the most important fruit growing districts of the Dominion.

That the Provincial Government of Ontario recognizing the serious nature of this pest, has passed legislation with a view to its eradication, which is confidently believed will soon be accomplished if no further introduction of the pest from abroad occurs.

That so important was immediate action for the protection of Canada's most important fruit industry, and so numerous were demands from fruit growers, fruit growers' associations, and others in all fruit growing sections of the Dominion, that the members of both Houses of Parliament, upon the introduction of the Bill, suspended the rules of the Houses and passed the Bill at once.

That this was done with the full knowledge that a number of Canadians would suffer in consequence of the sudden prohibition of all nursery stock, they having been agents for the distribution of this stock, and in many cases having been paid for it in advance.

That the results of the Act were referred to on a subsequent date in the House of Commons, and the Members evinced a strong determination not to recede in any particular from their action in passing the Bill.

The Minister, under the circumstances, is unable to recommend that for the present any modification be made to the provisions of the "San Jose Scale Act."

The Committee of the Privy Council, on the recommendation of the Minister of Agriculture, advise that Your Excellency be pleased to submit an answer, in the sense of this Minute, to His Excellency Her Majesty's Ambassador to the United States.

All which is respectfully submitted for Your Excellency's approval.

(Signed) JOHN J. MCGEE,
Clerk of the Privy Council.

DCXIV.—CHILLIES.

Pod peppers or Capsicums, the fruits of *Capsicum annuum* and allied species, are a well known spice and condiment. They are an indispensable ingredient in curries and are largely consumed in the fresh and dried state and in pickles. Some forms of Capsicums known as Bell peppers are entirely free from the acrid and burning pungency so characteristic of these fruits, and may be eaten cooked as a vegetable or in salads.

Chillies, Bird or Guinea Peppers the fruits of the shrubby *Capsicum minimum* (usually much smaller than the preceding) grow generally in tropical countries. These are in chief demand in commerce. When thoroughly dried and pounded, and afterwards passed through a hand mill and sifted, they are the principal source of the well-known Cayenne pepper.

It is estimated that about 100 tons of dried chillies are annually received in this country from the West Indies and the East and West Coasts of Africa. The price at which they are sold appears to be liable to considerable fluctuation. In May 1898, "50 bags dull Zanzibar sold without reserve at 29/- to 29/6: while 58 bags good Japan sold at 39/- to 41/- per cwt." A sample of capsicums grown at St. Lucia in the West Indies, dull and uneven in colour, were valued (in February last), in limited demand, at 20/- per cwt. What is evidently required is an article bright in colour, even in quality, and possessing great pungency.

ZANZIBAR CHILLIES.

In the *Kew Bulletin* (1892, p. 88) the following information respecting chillies was given in an article on the Agricultural Resources of Zanzibar, contributed by Sir John Kirk, G.C.M.G., K.C.B. :—

"The small red peppers or chillies are largely grown in the more dry and rocky part of the island, where the upheaved coral presents a honeycombed surface, that favours the accumulation of rich soil in the crevices. The pods are picked when ripe, sun-dried, and packed in mat bags made of the split frond of the *Hyphæne* palm for shipment. This is an industry that has sprung up within the last 30 years."

Zanzibar chillies, as they appear in the market in a dry state, are small, red, thin, carrot-shaped fruits about an inch in length.

The following further particulars are contained in a Report on the Spice and other Cultivation of Zanzibar and Pemba (F. O. Report, 1892, Misc. Series, No. 226) :—

'The pepper plant growing on the island is *Capsicum minimum*, usually termed the 'shrubby capsicum,' and producing the bird's-eye chillies forming the basis of cayenne

pepper. This is to be found in a small degree in every shamba, but the principal source from which the annual exports are derived is the eastern side of Zanzibar, and the cultivation here is chiefly in the hands of the Wahadinu people.

"Judging from observations made during my brief visit to this portion of the island, east of Dunga, the chillie cultivation struck me as being of a very scattered nature, generally small isolated patches from half to one or two acres in extent, and combined with tobacco, tomato, pumpkins, &c. I regret my inability to quote the annual total exports, but I believe they are large, and an undoubted source of revenue. As the chillie is, as yet, the only product of any value grown in this less favoured portion of the island, I consider that this cultivation could be extended, and that a little fostering care might be productive of much advantage. It is a cultivation easily carried on, and calling for no special trouble or skill, and the returns are certain and profitable. At present the people are so blind to their own interests as to purposely depreciate the value of this product. I understand that through fear of possible shortage by theft on the way down, owners actually damp the chillies before dispatching, and it is often necessary, on their reaching the Government Customs godowns, to dry them as quickly as is possible as the only chance of saving them.

"Another variety of pepper (? *Capsicum annuum*) bearing a larger red and yellow pod is also cultivated, but the produce from this is all consumed locally."

The latest account of Zanzibar chillies is contained in the Report of Mr. Consul Cave on the Trade and Commerce of Zanzibar for the year 1897 (Foreign Office, 1898, No. 2129, Annual Series):— "The production of chillies has risen from 16,336 frasilas in 1896 to 17,698 frasilas in 1897, an increase of 47,670 lbs. The average price was 2 dol. 37 c. per frasila, as against 2 dol. 57 c. per frasila during the previous year.* A better price than this could doubtless be obtained for Zanzibar produce if a little more care and attention were devoted to its cultivation and harvesting, but up to the present time it has been allowed to grow almost wild on the coral outcrop which covers the eastern portion of the island, and the slight personal discomfort which attends the handling of pods prevents the native from exercising any care in its picking and subsequent preparation for market. Attempts have lately been made to obtain a better sample on ground which has been specially cleared and prepared for the purpose, but the results are not yet to hand."

Japanese Chillies.

In a Note on Recent Additions to the Museum of the Pharmaceutical Society (*Pharm. Journ.*, Dec. 11, 1897), Mr. E. M. Holmes, F.L.S., furnished the following interesting particulars at an evening meeting of the Society, respecting Japanese and other Chillies.

"During the last three or four years there has been in commerce a very bright red variety of *Capsicum minimum*,

* A frasila = 35 lbs. avoir.

Roxb. (*C. fastigiatum*, Bl.), said to be imported from Japan. In consequence of its clean, bright, and attractive appearance it has commanded a higher price than other varieties. Mr. J. C. Umney has recently directed my attention to the fact that this variety is less pungent than the Sierra Leone and Zanzibar varieties, although far superior to them in colour. On further inquiry I find that this fact is well known to drug and spice brokers. Mr. Umney points out that when an alcoholic tincture of the Japanese and Zanzibar varieties are respectively diluted with about 14 parts of water, the former gives a much clearer solution than the latter, indicating less oily matter. All the bright red Cayenne pepper until recently in commerce is said to have been imported from Natal in that state. The entire pod pepper imported from Natal is a variety of *Capiscum annuum*, much larger than the chillies, and of a dark red colour and very pungent, whereas the powdered Japanese and Natal Cayenne peppers placed side by side are indistinguishable in point of colour. The other principal varieties of chillies at present in English commerce are, I am informed, those of Sierra Leone and Zanzibar, the former being of a yellowish-red tint, and the latter of a dull, dark red, and often of inferior quality, containing badly-dried fruits, stalks, and foreign matter, but both are more pungent than the Japanese kind. The latter is, however, quite pungent enough for most people, although perhaps unsuitable, by reason of its lesser pungency, for medicinal purposes, as an outward application, etc. I am indebted to Mr. Young, of the firm of Messrs. Dalton and Young, for information concerning the different commercial varieties and for specimens illustrating them. My object in directing attention to these commercial varieties is to point out to students and to retail chemists that there are often differences in the qualities and appearance of the same drug, which are worthy of careful observation, not only from a scientific, but also from a commercial point of view. Nepal Cayenne pepper is made from a small variety of *Capsicum annuum*, and is remarkable for its violet odour. Neither this kind nor the Zanzibar gives a red, but a brownish, powder.

The following comments on Mr. Holmes' paper were made at the meeting by Mr. MacEwan :—

"The subject of cayenne pepper was interesting to many chemists quite apart from medicinal purposes, probably more capsicum being sold for feeding birds than for any other purpose. The pepper used in that way was tasteless, and seemed to contain a large amount of fatty matter. It was dark in colour, and the object was to heighten the colour of the feathers. It was supposed to come from *Capsicum annuum*, and he should much like to know where it came from. It was only supplied by two or three houses, and attempts by others to obtain it had not been very successful. There was no doubt that the pepper as used was an untreated product. The late Dr. Brady, on his return from Japan, passing through Vienna, came across a comparatively tasteless pepper, which caused considerable discussion at the time, as there was a large amount of it on the market, but the substance had been pretty much lost sight of since. He thought it would well repay inquiry, as very little had been done on the subject of peppers since Dr. Thresh dealt with it about eighteen years ago."

According to a writer in Spon's *Encyclopædia*, Div. V., p. 1803:—
"Several varieties of *C. annuum* have little or no pungency; one of these is abundantly grown in Hungary, forming the paprika of the Magyárs. Another variety, cultivated in Spain, is imported into this country in powder for giving to canaries, to improve the colour of their feathers. The Nepal capsicums, which have an odour and flavour resembling orris-root, are the most esteemed as a condiment."

South American Peppers.

The following interesting account of the use of peppers in South America appeared in the *Saturday Review* of the 15th September, 1886 :—

"*Aji-aji.*—Pepper of peppers is the meaning of this compound Quichuan word, and both word and thing are largely distributed over South America, extending from the Bibo-Bio in the south to the Atrato in the north ; it is also found in the dialects of the Gran Chaco; in Aymara, in Andaqui, among the agricultural Indians of Chocó, the mining Indians of Potosi, and the Cerro de Pasco. . . . ."

"There are two kinds of aji; but there is only one way of preparing it. The best is that which is made from the greatest variety of peppers. The pods of these are taken when fresh, stripped of their seeds, and ground into a paste of the consistence of fresh spring butter. The paste is put into a small, well-dried gourd, prepared on purpose, of the size and shape of a well-grown orange.* The gourd, when thus charged, is then coated with a layer of well-tempered clay, and placed in the sun to dry, or to ripen, as the simple people who prepare it say in their own tongue. By the time when the clay is well baked, the pulp or paste within has been dried into a fine yellow powder, and is then fit for use. Many people, ignorant of this fine art of the Incas, have supposed, quite naturally, that these aji-laden gourds, with their exquisite flavour and refined taste, were some uncommon and little-known natural fruits. The other method of preparing aji is to grind the seeds with the pods, which simply adds great pungency to the pepper, and is always used in the preparation of maize or Indian corn, which is boiled in its own husk with much aji, and surpasses in flavour and pleasantness any vegetable curry of the East. The gourds of aji, when thoroughly ripe, are cleansed of their coating of clay, tied up in suitable leaves, well secured by the fibre of the aloe, and much resemble when ready for market reeves of large onions, a dozen gourds making up one reeve of aji. The cost of these in the good old times was fifteen pence for a dozen gourds; what the price may be now is only known on the Exchange. Time was when some of the old families of the interior who had passed their lives in ignorance of railways, daily newspapers, and quotations of the state of the markets, had their own special way of preparing aji, mixing with it some delicately-scented bark ground to powder, or other salutary substance known only to the reticent

* Specimens of these gourds are in the Kew Museum labelled "Gourds used in Chile for holding red pepper 'aji' (*Capsicum* spp.), from Mr. H. F. Stahlschmidt, 1885."

Indian. From such houses no visitor was ever allowed to take his departure without carrying with him a supply of the latest-made aji ; no traveller went to the capital or any of the coast towns but he carried with him some of this excellent pepper as a present to the archbishop or bishop of the diocese, the ladies of Santa Rosa, or the good Fathers who once a year went long journeys to baptise the children, marry their parents, and otherwise maintain the influence and authority of the Church in the remote parts of the earth. But even this good custom is fast dying out."

DCXV.—MISCELLANEOUS NOTES.

Mr. OLIVER TIETJENS HEMSLEY, a member of the gardening staff of the Royal Gardens, has been appointed, on the recommendation of Kew, by the Secretary of State for India in Council, a probationer gardener for employment in the Royal Botanic Gardens, Calcutta.

Mr. ALEXANDER WHYTE has been appointed by the Secretary of State for Foreign Affairs, Curator of the Botanic Garden, Uganda, about to be established "for the better examination and development of the agricultural resources of the Protectorate." Mr. Whyte had previously started a similar enterprise in British Central Africa, in which he was from 1891–7 Head of the Scientific Department. An interesting report of his work is given in the *Kew Bulletin* for 1895 (pp. 186-191). He made an important collection in North Nyasaland, a country which had never been previously explored botanically. A portion of the novelties was described in the *Kew Bulletin* for last year (pp. 243-300) and a further one is published in the present number.

Mr. JOHN WEIR.—The death of this old collector for the Royal Horticultural Society occurred on the 28th of April last, and was recorded in the *Gardeners' Chronicle* of May 14th. John Weir collected in Brazil and New Granada between 1861 and 1864, when he had an attack of fever followed by paralysis, from which he never completely recovered. In addition to living plants and seeds he made an extensive collection of dried plants, which were only partially distributed at the time. Many of the novelties among the flowering plants were described by the late John Miers, F.R.S., in the *Journal* of the Horticultural Society ; and the mosses by Mitten in the *Journal* of the Linnean Society. At the wish of the deceased the considerable residue of his collection was offered to Kew only a few days before his death.

Botanical Magazine for June.—*Crinum Woodrowi* is a fine new species from Central India, named after Mr. G. Marshall Woodrow, Professor of Botany in the College of Science, Poona, by whom

bulbs were sent to the Royal Gardens in January, 1897. *Morisia hypogaea*, native of the rocks and sandy shores of Sardinia and Corsica, is a dwarf Crucifer with golden-yellow flowers, borne singly on slender scapes which curve downwards after flowering, so that the young fruits become buried in the soil, where they mature. The plant flowers annually in the Rock Garden. *Celastrus articulatus* was raised from seeds communicated by Professor Sargent, Director of the Arnold Arboretum. Though insignificant at the flowering stage, it is a striking plant in the autumn when its fruits are ripe. The species is widely distributed in Eastern Asia, being found, amongst other places, in Manchuria, Central China, Formosa, Corea, and Japan. *Philadelphus mexicanus*, from Mexico and Guatemala, flowers annually on a south wall in the Royal Gardens, but it is not hardy. It differs from the solitary-flowered specimens of *P. grandiflorus* in having strongly fragrant flowers. *Orchis monophylla* was sent to the Royal Gardens by Mr. A. H. Hildebrand, C.I.E., Superintendent of the Southern Shan States. It is a native of the Shan Hills of Upper Burma, growing at an elevation of 4,000 feet.

Early Opening.—The open-air departments of the Royal Gardens were opened to the public by direction of Her Majesty's First Commissioner of Works and Public Buildings on June 1 at 10 o'clock. The arrangement will continue for the three following months.

The First Commissioner made the following statements on the subject in Parliament :—

"I have decided to admit the public to Kew Gardens (not including the plant houses) at an earlier hour than noon on week-days in the ensuing months of June, July, August, and September. I shall thereby be in a better position to judge of the extent of the demand by the general public for this earlier opening. There are many details involved in this proposal, into which I am having inquiry made, and I hope to give further information in a few weeks' time."—(*Times*, April 5.)

"The subject of opening Kew Gardens at an earlier hour was a difficult one, and it had occupied his attention for some time. There was never a difference of opinion as to opening Kew Gardens at an earlier hour subject to two conditions—that the Gardens would be taken advantage of by the public; and, secondly, that it would be safe in the interests of science and the students at Kew to grant an extension. It had at length been decided to open the Gardens on June 1, at 10 a.m., and to open them at that hour every morning for the following three months. If it was found that the public appreciated the new arrangement and patronized the Gardens to the extent that the advocates of the earlier opening of the Gardens said they would, the Office of Works would make the extension of hours—as far as the summer months went—permanent."—(*Times*, April 19.)

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 140.] AUGUST. [1898.

DCXVI.—COAGULATION OF RUBBER-MILK.

The extensive use of India-rubber in the arts and manufactures, renders the production of this substance a matter of general interest. One of the most important problems that awaits solution is a simple and effective means for coagulating the rubber-milk and producing an article free from impurities and capable of being worked with as little preparation as possible. In the following paper, which has recently appeared in the *Annals of Botany* (Vol. xii., pp. 165–171), Mr. R. H. Biffen, B.A., Demonstrator in Botany at the University of Cambridge, has given an admirable summary of what is already known on the subject. Mr. Biffen accompanied Mr. Esme Howard last year on a tour through the rubber-yielding countries of Tropical America. They visited Mexico, Central America, Brazil, and some of the West India Islands. Mr. Biffen has therefore had a favourable opportunity for becoming acquainted with the condititions under which rubber is at present prepared, and is in a position to suggest scientific methods for the improvement of the industry.

While engaged during the latter part of 1896 in studying the functions of latex, my attention was frequently called to its spontaneous coagulation when in contact with the air.

De Bary describes the phenomenon as follows* :—"As soon as latex comes in contact with the air, and still more quickly on treatment with water, alcohol, ether, or acids, coagula appear in the hitherto apparently homogeneous clear fluid itself, and independently of the aggregation of the insoluble bodies described by Mohl (*Bot. Zeit.*, 1843, No. 33). The coagula collect together and separate with the insoluble bodies from the clear fluid. These phenomena of coagulation which appear under the action of so various agencies point especially to a complicated composition of the fluid, and deserve further investigation."

An examination of the subject was therefore commenced with the small quantities of latex obtainable from plants grown for the

* De Bary, Comp. Anat. of Phanerogams and Ferns, p. 184.

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purpose in the Cambridge Botanical Gardens. The results obtained were of some interest, and accordingly the experiments were continued, together with other researches on a larger scale, in Mexico, Brazil, and the West Indian Islands.

Rubber-yielding plants, which always have laticiferous cells, were for the most part chosen on account of the ease with which large quantities of latex could be obtained, and because the various processes used in the preparation of crude rubber seemed likely to throw some light upon the subject.

A microscopic examination of any of these latices shows that its milky appearance is due to the presence of innumerable small granules of caoutchouc, which in themselves are soft and sticky, for they readily cohere to form a small mass of rubber if the cover-glass is lightly rubbed on the slide.

Some of the processes employed to prepare this rubber may be described here.

In the preparation of Para rubber, a thin layer of the latex of *Hevea brasiliensis* (Muell. Arg.) or other species of *Hevea*, is exposed to the action of the smoke of burning "urucuri" nuts (*Attalea excelsa*, Mart.); coagulation is immediately brought about, resulting in the formation of a soft, curdy mass of rubber, which on drying becomes tough and elastic.

The same process is now being applied with good results to the preparation of Ceará rubber from the latex of *Manihot Glaziovii* (Muell. Arg.).

The usually accepted explanation of this is that the water contained in the latex is simply evaporated off;* but as the coagulation is brought about in so short a time, and moreover as there is no loss of weight on its occurrence, this is obviously incorrect.

On passing the smoke of the burning Attalea nuts through a condenser, condensation occurs, and two layers of liquid are found in the receiver, one colourless and limpid, the other dark brown and oily. If these are separated by means of a pipette, or with a moistened filter paper, and analyzed, the former is found to consist mainly of acetic acid, and the latter of creosote and traces of pyridine derivatives.

On adding acetic acid to the crude latex of *Hevea* coagulation occurs immediately. This process of smoking the latex may then be classed with those mentioned by De Bary under the heading of treatment with acids. As other examples, the preparation of Lagos rubber from the latex of *Ficus Vogelii* (Miq.), in which case lime-juice is added,† and Helfer's process of adding acetic acid to the latex of *Artocarpus Chaplasha* (Roxb.),‡ may be quoted.

It is worthy of note that the latex of *Hevea brasiliensis* is in itself alkaline, and that the addition of a solution of ammonia preserves it indefinitely from spontaneous coagulation. The addition of alkalies brings about coagulation, however, in the latex of *Castilloa elastica*. In Mexico and Nicaragua, where this tree abounds, a decoction is made of the stems of the Moonflower *Ipomoea Bona-nox* (Calonyction speciosum), and added to the

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* Ernst, Trinidad Bulletin, vol. iii., p. 235.

† Kew Bulletin, 1890, Art. 142, p. 89.

‡ Watt's Dict. Economic Products of India, vol. iv., p. 343.

latex.* The alkaline properties of this extract are well known to the native Indians, who frequently employ it in the manufacture of soap. The latex has an acid reaction towards litmus paper, and the addition of acids does not cause coagulation.

Another method of clotting latex is to add an excess of common salt. This method is almost invariably applied in the case of *Hancornia speciosa* (Gomez) to produce the "mangabeira" rubber. It is also reported to have been employed at times to coagulate the latex of species of *Hevea* and *Manihot Glaziovii*.

Coagulation may also be brought about by boiling the latex, as, for example, in the preparation of "balata" from *Mimusops globosa* in Venezuela and Trinidad.

There are several other methods in general use besides the few that have been quoted, and many others have been suggested from time to time.†

As the rubber exists in particles in the latex, it seemed possible that the centrifugal method of separation might be adopted in examining the phenomena of coagulation. A modified form of the ordinary centrifugal milk-tester was, therefore, designed capable of being rotated some 6,000 times per minute.

The latex was taken directly from the trees, strained through wire gauze to remove any pieces of bark, and then, if very thick, diluted to about the consistency of thin cream. The first experiments were made with the latex of *Castilloa elastica*. After centrifugalizing for from three to four minutes, the rubber-particles completely separated as a thick, creamy, white layer, from the deep brown solution containing tannic acid in which they had been suspended. This layer was taken off, shaken with an excess of water to thoroughly wash it, and again separated. The separated particles were then shaken with water, so as to form an emulsion, and alkalies were added. No coagulation now occurred, even though the mixture was allowed to stand for several days. The particles could, however, be brought into a solid mass by pressure, by gently heating, or by drying off the water with a porous tile.

So prepared, the rubber formed a pure white mass, without any trace of its usually characteristic smell. On exposure to the air for several days, the surface became brown, probably owing to oxidation.

The percentage of rubber in the latex was estimated at the same time by separating 50 c.c. The weight of the dry substance was 12·5 grammes, which, as the specific gravity of *Castilloa elastica* latex is practically 1·0, gives a yield of 25 per cent.

On treating the latex of *Hevea brasiliensis* in the same way for a slightly longer time, a similar separation occurred. The same purely physical means as those employed in the case of the separated *Castilloa* rubber-particles caused them to coalesce to form a solid mass, while the addition of acetic acid and the action of the smoke of burning urucuri nuts had no effect.

The yield of rubber estimated as before, was from 28 to 30 per cent. The latex of *Manihot Glaziovii* also separated readily and

* Belt, Naturalist in Nicaragua, p. 33.

† For a complete account, see *Le Caoutchouc et la Gutta-percha*, Seeligman, Lamy, and Falconnet, Paris, 1896.

gave results completely parallel with those mentioned above. This latex is interesting, as it is readily clotted by churning. A soft spongy clot is formed in a few minutes containing in its meshes the greater part of the solution in which the rubber-particles were suspended. If this clot is cut into slices while still soft and pressed between sugar-cane crushers, or in a heavy press, the bulk of the solution is extracted and a fairly pure rubber is found. On drying, it does not give off the putrid smell characteristic of the ordinary Ceará "scrap."

Other latices can also be clotted by churning, but the process is a long one.

The latex of *Hancornia speciosa* and of *Mimusops globosa* gave similar results on centrifugalizing. In the case of the latter, the pink colouring-matter which characterizes 'balata' was found to have separated as a thin layer at the bottom of the tubes.

Artocarpus incisa contains a very viscous latex employed by the Brazilians as a bird-lime or as a substitute for glue. When diluted and centrifugalized it separates readily, giving a creamy white layer which dries to a resinous mass somewhat resembling gutta-percha. At the ordinary temperature this is quite hard and brittle, but if the temperature is raised slightly it becomes plastic, and at the temperature of boiling water it is soft and excessively sticky. The substance is soluble in carbon bi-sulphide, and nsoluble in alcohol and water.

*Urostigma Gamelleira** yields a similar substance of a chocolate-brown colour.

We thus see that the mere action of centrifugal force effects the separation of rubber; and from the failure of the processes usually employed, involving the use of chemical reagents, to bring about the clotting of the separated and washed rubber-particles, we must infer that no chemical change occurs in the rubber itself, and that the cause of coagulation must be looked for in the medium in which they are suspended.

From our knowledge of the constitution of latex, it is evident that the proteids are the most likely substances to cause this when treated with acids, alkalies, excess of salt, &c., and when boiled.

Unfortunately few latices have as yet been examined for their proteid constituents, chiefly on account of the difficulty of obtaining them in their natural condition in European laboratories, owing to their coagulating and undergoing decomposition during the journey from the tropics.† The investigations so far made prove the presence of albumin, globulin, albumose, and peptone in several rubber-yielding latices.‡ In the clear solution left after separation of the rubber-particles the xanthoproteic reaction always showed the presence of proteid matters, but under the circumstances it was impossible to identify them.

Now albumins are characterized by the coagulation of their solutions on heating, especially in the presence of dilute acids, and globulins by their ready precipitation with the salt-solution and their coagulation on heating.

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* Mart. Fl. Bras. 4. i. 93. Ficus doliarum of Mart. Sys. Mat. Med. Bras., p. 88.

† This does not apply to the latex of *Mimusops globosa*, or *Hancornia speciosa*, both of which may be kept for months without undergoing any change.

‡ J. R Green, Proc. Roy. Soc., 1886, p. 28

Thus when the latex of *Hevea brasiliensis* is held in the smoke of the burning urucuri nuts, the albumin it contains* is clotted by the action of heat in the presence of dilute acetic acid.

The globulin of *Manihot Glaziovii* latex coagulates on heating when the temperature rises to 74–76° C.†

The acid latex of *Castilloa elastica* contains an acid albumin, which on neutralization forms a gelatinous precipitate.

These coagula on forming gather up the rubber-particles (and probably starch-grains also, in the case of starch-containing latices) in the same way as the white-of-egg gathers up particles in suspension when clotted for the purpose of clearing jellies. We may even push the old analogy of blood and latex further, and compare the formation of a rubber-clot, in many cases, to the formation of a blood-clot, the rubber-particles being bound together by coagulated proteids in the same way as the blood-corpuscles are bound together by fibrin. In this case, however, we must remember that the rubber-particles, owing to their being sticky bodies unprotected by any external film, as *e.g.*, the fat-particles of milk are, are capable of aggregating together of their own accord to form a solid mass.

Rubber then, as now prepared, contains among other substances proteid matters. To these must be ascribed the well-known 'fermentative change' which causes a considerable loss by converting the solid blocks of rubber into a foul-smelling spongy substance. In the Para rubber the creosote absorbed from the smoke of the burning nuts acts as an antiseptic and prevents this proteid decomposition.‡

To test for the coagulated proteids is not an easy matter: continued boiling with a concentrated solution of caustic potash will, however, extract small quantities of alkali-albumin. 'Balata' gives good results most readily. On extraction with caustic potash a flocculent precipitate is obtained, which is readily soluble in dilute nitric acid, and is reprecipitated on the addition of alkalies. Boiling precipitates it either in acid or alkaline solutions, and it gives no precipitate with acetic acid and potassium ferro-cyanide. The proteid is thus identical with the albumose, described by Green, from the latex of *Mimusops globosa*.

R. H. BIFFEN.

Botanical Laboratory, Cambridge.
February, 1898.

DCXVII.—KENDIR FIBRE.

(*Apocynum venetum*, Linn.)

In November, 1896, a letter was received from the Foreign Office, forwarding a copy of a Report on the Nijni-Novgorod Exhibition of 1896, containing a reference to a fibre plant successfully used in the manufacture of Russian paper money. With the report a packet of the seed of the plant was received.

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* Faraday—*see* Le Caoutchouc et la gutta-percha.
† J. R. Green, ibid.
‡ Cf., the smoking of fish, &c., for preserving purposes.

The following particulars were furnished (*Foreign Office Reports*, 1896, *Miscellaneous* Series, No. 409, pp. 16–17) :—

"Attention was especially drawn to a plant (*Apocynum sibericum*) which grows wild in the Semiraychinsky district, near the River Amu Daria, and the Ili. The local name is "Kendir," or "Turka," and it is much employed by the natives, who use the fibre for their ropes and fishing nets. Its chief properties seem to be the very great strength of the fibre, and the fact that it grows without irrigation. Specimens have been shown at various Russian Exhibitions, but the Government only took serious steps to procure any large quantities in 1894, and in the following year it was used successfully in the manufacture of Russian paper money.

"With the seed brought back in 1894, sowings were made in various parts of Russia, and these gave good results at Poltava, where the plants grew to a height of four feet in two years. In a wild state it reaches a height of six feet, growing best when on a hill-side near a river, sufficiently low to benefit by the spring floods. I enclose a small sample of seed, and some flax from the autumn crop ; that gathered in the spring is of a lighter shade."

The seed sown at Kew germinated this summer and yielded four plants. From these it was possible to identify the species as *Apocynum venetum*, L., of which A. sibiricum is a synonym. (See *Journal Linnean Society*, xxvi., p. 98.)

In the *Flora of British India*, iii., p. 657, *Apocynum venetum*, L., is described as an undershrub with slender cylindrical stems and branches. Leaves 2–3 ins. long by $\frac{1}{2}$–$\frac{3}{4}$ in. broad, linear oblong or oblong lanceolate, entire or crenulate ; nerves very slender ; petiole very short. Flowers in small, erect, sub-corymbose cymes : bracts subulate, $\frac{1}{8}$ in. diam., purplish, puberulous. Fruit consisting of two long, slender follicles. The plant is distributed from Southern Europe to Asia Minor, through Siberia and Northern India to Mandshuria and Japan.

The following account, with a plate, is given by Dr. J. E. T. Aitchison, C.I.E., in the *Transactions of the Linnean Society*, 2nd Ser. Bot. iii., p. 87, t. 37, on the Botany of the Afghan Delimitation Commission of 1884–85 :—

Apocynum venetum, *Linn.*; *Boiss. Fl. Or.* iv. p. 48 (plate xxxvii.).

Badghis : 115, March 5, 1885. Native names : Dumb-i-roba, Kundar, Dumb-i-gosalla. Common in beds of streams and in marshy localities at Gulran, at an altitude of 2,000 feet. Stems about 4 ft. high, springing from a creeping rootstock, and terminating in a panicle of flowers. The annual stems remain attached to the rootstocks, but by the action of the wind they are soon reduced to their fibrous element, and this is found in bunches, having the appearance of artificial preparation. My attention was attracted to them by the seed-vessels still persistent on the battered branches. The fibre is a most excellent one, and the wonder is, as the plant seems to be common from Eastern Europe to China, that it has not heretofore been employed in manufactures. The bark of the creeping rootstocks is employed in tanning the leather skins used as water bottles.

Roots of this plant were sent to Saharunpore, whence we received flowering specimens for the Herbarium at Kew.

A more detailed account of the plant had previously been received from Dr. Aitchison.

DR. J. E. T. AITCHISON TO ROYAL GARDENS, KEW.

Gulran, 8th March, 1883.

DEAR SIR JOSEPH HOOKER,

SINCE I wrote last to you only a couple of days ago, I have come across a find—an Asclepiad, a fibre plant that grows in marshy land, amongst loam with sweet water, about five feet high, annual shoots from a woody rootstock, and great creeping thick roots.

I first of all noticed the shrub-like plant in good seed, and the seed flying about out of a pair of very long pods that belong to the Apocynaceæ, the seeds with silky plumes. On examining the stems, bundles of several years' collected together, the bases were covered with a mass of what looked like tow (naturally exfoliated from the standing stems by rubbing against each other during a wind), very silky, and a good fibre. This natural tow, with the fruit and seeds, I have sent you by sample post. The natives of the surrounding parts, especially the Turkomans, say that ordinary twine and rope is made from the fibre, but that a tribe of Turkomans, called Kayák, east of Bokhara, who live at a place called Kallá, manufacture cloth from this fibre. The natives here call that cloth Katán. The plant is called Dūmb-e-robá (tail of fox), or Dúmb-e-Gósallá (tail of calf), this name, no doubt, due to the fluffy seed.

The bark of the rootstock is employed for tanning, or rather preparing, skins to hold water, and it is known as "Gao-gosh" (cow's ear). These skins become red in preparation and waterproof.

A Russian traveller, Prejevalsky, mentions a cloth being made at Lobnor, in his travels, from an Asclepiad.

As I think it is likely to turn out a good thing, I have sent to Saharunpore a large number of the roots, which were just showing eyes like potatos, and hope they may succeed. I have no doubt, if you have Prejevalsky's species, that you will be able to recognize my plant from the fruit. This is nearly 5 ins. long, and not thicker than ¼ in. With the seeds, you will be able to raise some plants. The roots during winter are covered with water, and in summer I should say are almost dry. It is in immense quantities in this vicinity, only in marshy ground. The natives call the cloth Katán, but this is the Persian name for linen and hemp fabrics indiscriminately. We would require to get the true Turki name.

Forsyth, in his Yarkand report, mentions a cloth called "Luf." I feel sure this is the same. Native information said it was produced from a plant that had a fruit like the Liquorice.

The annual shoots, growing in March and coming to perfection during the summer, would lead one to suppose it might do well in India. The fibre I have sent you is merely what I collected on the stalks, but, of course, if collected at the proper season, it would be of much better quality—as it is, it is very good.

I am, &c.,

(Signed) J. E. T. AITCHISON.

DCXVIII.—CAROB TREE.

(*Ceratonia Siliqua*, L.).

The Carob or Algaroba tree is a native of Southern Europe. It is a leguminous plant, usually from 15 to 25 feet high, with few branches and dark green pinnate leaves composed of two or three pairs of leaflets of a leathery texture. The flowers are polygamous or diœcious (*i.e.*, either self-fertilising or unisexual on different plants), arranged in small red racemes. The pods, known as Locust beans or St. John's Bread, are full of a sweet mucilaginous pulp, six to ten inches long, and contain numerous seeds. They are often eaten by the poorer people in the Levant, and serve as a useful food for cattle. The seeds are also said to be used in the preparation of mucilage. In Italy and Southern Spain the tree is cultivated in dry, stony localities, and yields valuable crops. The value of the carob pods exported from Cyprus has, in some years, reached £65,000.

There are several cultivated varieties, and as the tree is usually diœcious it is necessary to engraft seedling plants in order to ensure large crops. "In the case of [fully grown] male trees each branch is usually grafted from a female tree, reserving one ungrafted male branch to ensure fertilisation . . . if the tree is female, one branch must be grafted with a male branch for the same purpose."—(*Haldane.*) For cultivation in hot and dry districts, with stony soils, there is little doubt that the carob is a valuable tree, and deserves to be widely cultivated. It requires warmer conditions than the orange, *i.e.*, a mean yearly temperature of, say, 66° F. It is said to prefer a calcareous subsoil. It begins to bear at about eight years old. A single large tree may yield pods weighing in the aggregate about 2 cwts.

Carob trees are familiar objects in some parts of the Canary Islands, especially above Puerto Cruz, in Tenerife. There they are evidently seedlings, and produce only a scanty crop of pods. In the garden of Dr. Grabham, at Funchal, Madeira, there is a very handsome carob tree. The main stem has a circumference of 15 feet; at about 8 feet from the base it divides into numerous wide-spreading branches, and covers a considerable area. As it is the only tree in the neighbourhood and produces a fair crop, it is probably self-fertilised.

The carob tree was introduced to Jamaica in 1883, chiefly from seed gathered by the present Assistant-Director of Kew, from the Madeira tree above mentioned. The plants have grown well in the plains, but those that have hitherto flowered have produced male flowers only. Steps are now being taken to introduce grafted plants from Naples.

An interesting report on the carob tree has lately been presented to the Foreign Office by Mr. E. Neville-Rolfe, Her Majesty's Consul at Naples (F. O. Miscellaneous Series, 1897, No. 431). This is reproduced below. It contains valuable hints

respecting the propagation and cultural treatment of the tree in Italy :—

Report on the Cultivation of the Carob or Locust-bean Tree.

In the course of last spring a well-known gentleman from South Africa made inquiries at this Consulate concerning the cultivation of the carob or locust-bean tree and the possibilities of its introduction into the Cape Colony. The carob is a tree the fruit of which consists of a long pod, which not only forms excellent horse-food, but is very largely eaten by human beings, especially children, on account of its sweetness. The pods contain very hard beans, which are useful only for seed, as horses leave them in their mangers, and if by chance they swallow them, it is found that they do not digest them. The tree bears, moreover, thick dark ever-green foliage, which gives a cool and grateful shade. It grows in many places in the Mediterranean where nothing else will grow, notably on the arid hills of Malta, and it seems certain that in the endless varieties of soil and climate to be met with in the Cape Colony there must be many districts where it would grow freely. The successful result of such an experiment would be simply invaluable to the colony if merely as a supply for horse-food, for one of the greatest difficulties in travelling at the Cape is to feed one's horses, the price of forage in some districts being extremely high, and the supply often distressingly short. Forage, moreover, as it consists of oats with their straw, is not readily portable, but carobs enough for a pair of horses for a day can be carried in a small bag. The carob in Italy grows alongside the oranges and lemons, and there can be no reason why it should not grow with the magnificent orange trees of Wellington, and become as superior to the carob of Italy as the Cape orange tree is superior to its Italian prototype. In places like Graaf-Reinet, and Aliwal North, the success of the experiment seems absolutely certain, while, judging from the way the tree prospers on the dry stone of Malta, where it grows with apparently no soil to help it, there is good hope that it might take kindly to the "Kopjes" near Colesberg, the bush veldt of the Western coast, the lower slopes of the Drakenfelds, or among the trees of the Knysna forest. The writer being well acquainted with the Cape Colony, has had much pleasure in investigating the matter thoroughly, and, after lengthened consultation with practical arboriculturists, the following *modus operandi* has been decided upon. First, a sufficient quantity of seed will be sent out to grow a number of seedlings in different parts of the colony. These seeds will produce carobasters, which will not have a fruit worthy of the name till they are grafted. The strongest seedlings may be grafted in their third year, but it is of no use to graft until the plant is strong and well grown, which may not be till it is five or even seven years old.

A number of plants in pots will be grafted here next spring, repotted in larger pots with plenty of clay, and when the grafts have taken well the trees will be packed, the clay well soaked in water, and it is confidently hoped that they will bear the journey satisfactorily. They will be sent from here in the month of February, and will probably travel *viâ* England, which seems climatically preferable to the East Coast route, by German steamer

to Durban *viâ* Zanzibar. If the coincidence of the steamers can be secured, they may reach Cape Town within a month of their despatch from here, or even less, but if not, we have no doubt that the steamship company will see that the roots are kept carefully wetted while the trees are in bond at the port of origin. It is with the object of keeping the roots wet that they are now being repotted in stiff clay, a soil which is in itself favourable to the growth of the tree.

Having thus given a general sketch of the scheme, it is necessary for its success to enter into minute detail as to the method to be employed in the cultivation of the trees. We will first take the plants to be exported two years hence, because these are ultimately the most important part of the subject. If they should succeed, the acclimatisation of the tree at the Cape is assured ; if they fail, the seedlings will be comparatively valueless for want of grafts. It is the fixed opinion of people here who have studied the subject closely that there would be no chance of grafts sent out arriving in a condition to be of any value whatever, so that it becomes absolutely necessary to send out the plants themselves ; besides, when the plants at the Cape were ready to be grafted, our grafts would be out of season here. We have already secured some excellent plants, from each of which a large number of grafts should be available. It does not seem possible to secure plants already grafted, for the reason that they are not usually grafted in pots, the operation being performed after they are planted out and have got a good hold on the soil which is to be their permanent home. We cannot graft these plants till May, 1898, nor can we be sure of the success of the operation till May, 1899, when the plants will be sent out. The carob is a tree which cannot be transplanted on account of its tap-root, so that once planted it must remain where it is ; it is therefore very essential to plant it in the right place to begin with. In the case of our plants it will be necessary to top them and to cut off every leaf in order that the sap may not be exhausted by the foliage when it begins to rise. We shall consequently export mere skeletons to the colony ; and here again we have another difficulty to contend with, namely, the change of season. The plants will leave here at the end of our winter, and will arrive at Cape Town at the beginning of the South African winter. They will thus have a great strain put upon their nature, and great care will have to be taken of them to enable them to overcome it. This care they will certainly have at the hands of the managers of the Botanical Gardens in the colony, so that this is one of the least of our anxieties. The details in this report would therefore be unnecessary but for the fact that as the experiment will be tried on an important scale, and many of the plants will fall under the care of less capable hands, it is advisable to give very clear instructions. On arrival at their destination the plants must be carefully potted in garden mould, to which a little old farmyard manure should be added, and the pots must be moved from time to time to prevent the plants striking a tap-root through the hole at the bottom of the pot into the soil, in which case they will certainly perish. They will not require very much water, in fact the climate of South Africa so much resembles that of Naples that were it not for the clay which we must send with them the plants

scarcely require water at all in the Cape winter. If, however, this clay gets hardened it may kill the rootlets which by that time will have spread into it, and give the tree a worse chance, so that the clay must be kept moist. It may be desired to plant the trees out at once, but this should not be done in windy weather, and on the whole it will be safer to pot them, at all events for a few months till they can recover from their journey.

With regard to the seedlings, they should be sown in pots with proper drainage, and in garden mould, with a slight sprinkling of old, short, farmyard manure. The greatest care must be taken to move the pots often enough to prevent a tap-root being struck through the pot into the ground beneath. Experiments may safely be made by sowing seeds in the spots where they are intended to remain, and grafting them when the plants come to maturity, but this should be done in enclosed gardens or places where the plants can be guaranteed from being choked by weeds, nibbled by sheep or game, or otherwise harassed in their early years. The carob grows freely in dry soils, but, economically speaking, it has been found preferable to raise them in pots. The seeds will be sent out in the pods, as this has proved to be the best method for their preservation. It is desirable to remove the beans from the pods, and soak the beans for four days before sowing them ; the seed thus gets softened, and germinates more rapidly. At Naples the seeds are sown in February and March, but they are apt to sprout very unequally. The majority grow freely and well, but some come up as late as October, and then generally develop weak plants. The strongest seedlings may be potted at the end of the first year, or even as early as November ; the weaker ones at the close of the second. They must be kept in pots till they are finally planted, as they will not bear transplanting, and windy weather should be avoided for these operations. The experiments conducted here show that it takes a minimum of four years and a maximum of seven to produce a plant. A strong plant may be planted out in safety in five years, but much depends on the skilful care of the seedlings in the nursery. Each plant brought to maturity in this country is calculated to cost *8d.*, and it has been found by experiments that it is cheaper in the long run to grow the plants in the nursery than to sow them in the open ground. They are not particular as to soil, and grow freely in clay, if not too wet, in sandy soils, and in the clefts of rocks, where, of course, holes of about a cubic yard must be dug for them and filled up with soil, drainage being provided in the ordinary way. It is usually necessary to build a rampart of stones in the shape of a crescent on the lower side of the hole to prevent the soil from being washed away. On "Kopjes" and hill sides the trees must be planted on such spots as offer a position, unless the hill has soil enough to be terraced, but on open arable land they should be planted in rows from 12 to 15 yards apart. The intervening ground can be used for garden crops, but these must not be grown within four feet of the young trees, although the ground round the trees may advantageously be dug over when the rest is prepared for cropping. Exhausting crops, such as corn and mealies, must not be grown, but cabbages and garden produce generally will do no harm.

It is better to let the plants obtain a strong growth before

attempting to graft them, the third year being about as early as it is prudent to do it. If a plant is very full of leaf it is desirable to leave it alone and not to graft it at all, for a reason which will appear below, and also because being leafy it may be taken to be a good variety. The season for grafting here is from the middle of May to the end of June, the grafter being careful to see that the bark opens easily. The best plan is to graft on the boughs and not on the stem, leaving the smaller boughs to utilise the winter deposit of sap, which may otherwise prove injurious to the grafts. These boughs can be cut off in the following year. The carob can also be satisfactorily budded, or grafted by sawing off the trunk and cleaving it. In windy situations it will be necessary to bind canes to the grafted boughs to stiffen them, and to prevent the grafts from moving. The best two varieties of carob are both called here the "Honey bag": one bears a long narrow pod, the other a short wide one.

The object of leaving a fair sprinkling (say 25 per cent.) of ungrafted trees in a grove is the following. The grafted tree produces almost exclusively female flowers, the ungrafted tree males. Unless these flowers are in due proportion there can be no crop; and in fact this was the primary cause of the failure of a carob grove in Sicily, a cause which was discovered and remedied by Professor Bianca. In planting these trees on ordinary arable land great inequality will often be found in the plants, which arises from the fact that the carob cannot support water. Hence, where water accumulates in the subsoil the tree will not grow, whereas, where the water drains away, it will grow freely, and for this reason a hill side is the best situation for a grove.

Some years ago the Italian Alpine Club agreed that it would be greatly to the advantage of South Italy, and would add materially to the attractions of the mountain scenery, if the Apennines, which are now for the most part quite bare, could be made to grow trees such as there is every reason to believe that they did in more ancient times. They determined to consult Signor Savastano, the professor of arboriculture in the school of agriculture at Portici, near Naples, who gave it as his opinion that the mountains where the lentisk and the myrtle grow freely enough could be utilised to produce the more remunerative carob. To the obvious advantage of reafforesting the mountains, and thus adding to the rainfall, would be added the production of a valuable crop where nothing saleable had grown before.

The great carob-growing districts of South Italy are in the Bari region, on the Adriatic coast, and quantities are exported annually to Russia and Central Europe from Brindisi and the other ports along the coast. Though the tree may be seen in almost any garden here, and is not uncommonly found on the mountains, the only person who has made a hobby of its cultivation is the Prince of Belmonte, who has large properties in the province of Salerno, not far from the ruins of Paestum. Besides planting several trees in his shrubbery, the Prince has a long avenue of them leading up to his house, which is particularly interesting, and is, we believe, the only avenue of its kind. The trees are planted 7 metres apart, and the largest of them has a trunk of 85 centimetres (about 2 feet 9 inches) in circumference. This tree is 18 years old, and its top is from 6 to 7 metres in diameter, and

4 or 5 in height. In common with the other trees of the avenue, the fruit is of the best description, and each tree may be taken to yield annually 50 kilos, or say 120 lbs. of fruit, worth here about 6 shillings. This may be spoken of as the ornamental part of the work, while the plantations of Licosa and Tresina are more on the scale of a commercial enterprise. They are both germane to our present purpose, as they show in what different circumstances the carob will grow and flourish. The Licosa grove is in a plain by the seaside, and the difference of the trees is very remarkable, some of them growing with great vigour, others not flourishing at all. The reason of this must be the existence of land-springs beneath the surface with which the weaker trees come into contact, and by which their growth is checked. There is no other apparent reason, and as the grove consists of about 1,500 trees there is scope for observation. The site is very much exposed to the wind, and in the first attempts at forming the grove as many as 70 per cent. of the plants were lost. There were other causes too which led up to this heavy loss. First, the whole thing being an experiment, they did not know at what period and in what way it was best to graft the trees, and also the grafters had not anything like the skill which they have since acquired.

The grove at Tresina is planted in altogether different conditions. Here we have a hilly country fully 1,000 feet above the sea, and here the outside loss of plants has been 20 per cent., which is not more than occurs in the planting of ordinary forest trees. The plantation consisted originally of 7,000 trees, but has been largely increased year by year, and the Prince expresses every confidence that in a few years' time he will clothe the barren slopes with a mantle of luxuriant green. Professor Savastano asks very pertinently why, if these results can be obtained at Tresina, they should not be obtained elsewhere, and thousands of barren acres of Italian mountains be made useful and productive. And, in fact, since he wrote upon the matter, the spread of this cultivation has been steady and continuous. We have shown pretty plainly that Prince Belmonte has attained success only by patient experiments extending over a considerable number of years. Commercially speaking he is abundantly satisfied with the results obtained, but he does not relax his efforts. He rears some 8,000 seedlings every year, and has a skilled staff to conduct all the necessary operations, with the result that he grows a valuable crop on ground which before was absolutely unproductive ; and if the landed proprietors of South Africa profit by his experience, and are equally persevering, and the tree, as is anticipated, proceeds to grow like a weed, its introduction should form a mine of wealth to our industrious colonists. There is one important advantage that the carob has over other beans, namely, that it does not require threshing. In feeding horses it is usual to break the pod into two or three pieces and to put it in the nosebag or manger mixed with bran.

E. Neville-Rolfe.

DCXIX.—SHINIA IN CYPRUS—(continued).

(*Pistacia Lentiscus.*)

The use of the leaves of *Pistacia Lentiscus* as a substitute for Sumach was noticed in the *Kew Bulletin* (1897, pp. 421–422). It has since been chemically studied at the Clothworkers' Research Laboratory, Leeds, by Messrs. Perkin and P. J. Wood. The following results are taken from the *Transactions of the Chemical Society* for 1898 (pp. 374–379) :—

"During the investigation of Sicilian sumach, the attention of one of us was directed to the excessive adulteration that the commercial article is frequently subjected to, much care on this account being necessary to ensure that the material then examined was a pure sample of the leaves of the *Rhus Coriaria.* It was interesting, however, to examine also authentic samples of the adulterants, could these be procured. Owing, apparently to the desire of the Sicilians to keep the nature of these adulterants secret, attempts to procure them were at first a failure, although application to Sicily was made for us by large and well-known merchants in this country. Ultimately, we were fortunate in obtaining the aid of Mr. P. Gennadius, the Director of Agriculture of Cyprus, who readily supplied us with the required materials, for which our best thanks are due.

"Owing to the excessive adulteration of sumach, the quantity exported from Palermo has continually decreased (*Kew Bulletin*, 1895, p. 294), and this has been discussed in the *Eco dei Campi e dei Boschi* (Rome, February 16, 1897, p. 99) and *Bulletin de la Société nationale d'Acclimation* (Paris, May, 1896). The adulteration consists in grinding with the sumach the leaves of other plants, principally those of *Pistacia Lentiscus*, *Ficus Carica*, *Ailanthus glandulosa*, *Tamarix africana*, and probably also *Arctostaphylos Uva ursi*, and such a mixture, when ground, does not differ in appearance from ground sumach itself. With the aid of the microscope, however, it has lately been found possible to detect this adulteration to some extent, for, of the above plants, the leaves of the *R. Coriaria* (sumach) alone are covered with minute, hair-like threads. The difficulty could be readily overcome by importing sumach in the underground leaf form only ; any foreign admixture would then be at once visible. It is worthy of remark that Cyprus exports annually much unadulterated sumach in leaves.

"*Pistacia Lentiscus* is a small tree about 20 feet high with evergreen leaves, which grows abundantly in most parts of Cyprus, where it is called 'shinia.' For some time the leaves were exported to England by the Cyprus Company, but now are hardly known in this country, although a considerable quantity is consumed at Lyons, in France, as an assistant dyeing material for silk stuffs. About 10,000 tons are exported from Tunis to Sicily annually at a price of 2*s.* per 100 kilos., and are re-exported from there (as sumach ?) at 3*s.* 7*d.* to 5*s.* 7*d.* for the same quantity.

"For the sample examined, we are indebted to the kindness of Mr. P. Gennadius, the Director of Agriculture of Cyprus. From one thousand grams of the ground leaves the yield of colouring matter was 1·5 grams, or 0·15 per cent. This was obtained as a lustrous mass of yellow needles, soluble in strong potassium hydroxide solution with a yellow coloration, which, on dilution, changed to a deep green.

"From the colouring matter, by fusion with alkali, two products were obtained, melting respectively at 210° and 238°—240°. The former was found to be *phloroglucinol*, and the latter, which gave a blue-black coloration with ferric chloride, was evidently *gallic acid*.

"The colouring matter of the leaves of *Pistacia Lentiscus* is, therefore, indentical with *myricetin*, which has been previously shown to exist in *Rhus Coriaria*, or Sicilian sumach, *R. Cotinus*, and *Myrica Nagi*.

"Judging from the fact that an aqueous extract of shinia leaves dyes calico mordanted with iron a blue-black shade, it appeared probable that the tannin which they contain was ordinary gallotannin. The deep, red-brown coloration produced on boiling an extract of the leaves with dilute sulphuric acid was, however, a property usually indicative of a catechol, rather than a gallotannin; moreover, some qualitative tests which Professor Procter kindly carried out for us also hardly corroborated this view.

"It seems that the leaves of *Pistacia Lentiscus* contain gallotannic acid and a *new tannin* or *tannin glucoside*.

"*Tanning Properties.*—According to Sir Thomas Wardle (private communication), the shinia leaves contain 11·29 per cent. of tannin. Under the direction of Professor Procter, a sample of the material employed in the above investigation was analysed by the International Conference method.

"Tannin matter	11·3	per cent.
"Soluble non-tannins	22·3	"
"Insoluble at 60° F.	58·3	"
"Water	8·1	"
	"100·0	

"A good, plump leather is obtained from this material, but of a faintly reddish tint, the result being intermediate in character between those which are given by oak bark and sumach. Although evidently a useful tanning agent for dressing leather, it cannot be employed as a substitute for sumach, when a very light coloured leather is required, but in other respects it has very similar properties.

"Experiments on the utility of shinia leaves as an assistant for the fixation of basic colouring matters upon cotton fabrics indicated, as was to be expected, that they have only half the strength of sumach. When twice the quantity was used, good results were obtained, although the paler shades had a greener and duller character; it seemed, therefore, that shinia leaves would be best employed for the production of the darker tints."

DCXX.—NEW ORCHIDS.—DECADES 21 and 22.

201. **Pleurothallis** (§**Aggregatæ**) **rufa**, *Rolfe;* ad *P. vittatam*, Lindl., accedit, recedit foliis angustioribus, floribus subfasciculatis et multo minoribus.

Caules subteretes, 3–4 poll. longi, obtuse angulati. *Folia* lineari-oblonga, subobtusa, subcanaliculata, crassa, 3½–4 poll. longa, 6–8 lin. lata. *Flores* subfasciculati v. in racemum brevissimum dispositi, carnosi. *Bracteæ* spathaceæ, truncatæ, parvæ, glaucæ, ½ lin. longæ. *Sepalum* posticum oblongum, subobtusum, 2 lin. longum; lateralia elliptico-oblonga, obtusa v. apiculata, supra medium connata, 2 lin. longa. *Petala* oblongo-lanceolata, subobtusa, obscure crenulata, 1 lin. longa. *Labellum* subtrilobum, elliptico-oblongum, obtusum, crenulato-undulatum, canaliculatum, 1 lin. longum, medio bicarinatum, lobis lateralibus parvis obtusis. *Columna* 1 lin. longa, apice late alata.

MEXICO.

Flowered in Messrs. Seeger and Tropp's Nursery, East Dulwich, in June, 1890. Flowers dull brownish red with a brown lip.

202. **Platyclinis rufa**, *Rolfe;* ad *P. uncatam*, Rolfe, accedit, recedit racemis brevioribus et floribus rufo-brunneis.

Pseudobulbi cæspitosi, ovoideo-oblongi, monophylli, 6 lin. longi. *Folia* linearia, acuta, 9–10 poll. longa, 4–5 lin. lata, basi attenuata. *Scapi* graciles, 6–7 poll. longi. *Racemi* distichi, 1–1½ poll. longi, multiflori. *Bracteæ* lanceolato-oblongæ, subacutæ, 2 lin. longæ, marginibus involutis. *Pedicelli* vix 1 lin. longi. *Sepala* ovata, acuminata, concava, carinata, 1¾ lin. longa. *Petala* oblonga, acuminata, concava, 1¾ lin. longa. *Labellum* trilobum, 1½ lin. longum, 1¼ lin. latum, basi subsaccatum, lobis lateralibus latis obtusissimis utrinque angulatis, intermedio triangulari-ovato subobtuso, disco inter lobos laterales bicalloso, callis latis transversis obtusis. *Columna* gracilis, incurva, 1 lin. longa, infra medium utrinque bidenticulata, rostello oblongo.

TROPICAL ASIA.

Flowered in the Royal Botanic Gardens, Glasnevin, in February, 1894. Flowers reddish-brown, a colour very unusual in the genus.

203. **Dendrobium** (§**Pedilonum**) **cymbiforme**, *Rolfe;* ad *D. hamatam*, Rolfe, accedit, recedit multo minore, et labello late flabellato-dilatato.

Pseudobulbi erecti, teretes, subgraciles, ½–1 ped. longi. *Folia* oblongo-lanceolata, acuta, 2–2½ poll. longa, 6–7 lin. lata. *Racemi* axillares, biflori, 4 lin. longi, basi breviter tubuloso-vaginati. *Bracteæ* ovato-oblongæ, obtusæ, 1 lin. longæ. *Pedicelli* 7–8 lin. longi. *Sepalum* posticum ovato-oblongum, subobtusum, 6 lin. longum, 3½–4 lin. latum; lateralia triangulari-ovata, subobtusa, 5 lin. lata, basi in mentum calcaratum incurvum obtusum extenta. *Petala* obovato-oblonga, obtusa, circiter 7 lin. longa, 4 lin. lata. *Labellum* unguiculatum; unguis 4 lin. longus; limbus flabellato-dilatatus, truncatus, 6 lin. longus, explanatus 11 lin. latus.

lateribus erectus, medio gibbosus, supra medium constrictus, apice recurvus crenulato-undulatus ; callus cymbiformis ad unguem situs, 3 lin. longus. *Columna* brevis et lata, 2 lin. longa : stigma valde concavum. *Mentum* 8 lin. longum.

SUMATRA.

A remarkable species which flowered in the collection of Mr. L. Kienast, of Horgen, near Zurich, in April 1896. Flowers straw-yellow, a little whiter on the petals, with about five purple stripes on each of the sepals and petals, and a number of similar lines at the apex of the lip.

204. **Dendrobium hirtulum**, *Rolfe ;* ad *D. stuposum*, Lindl., accedit, recedit labello subintegro, racemo breviore, pedicello longiore et floris colore.

Caules elongati, teretes, paullo incrassati, 9–13 poll. longi. *Folia* oblonga v. lineari-oblonga, subobtusa, $1\frac{1}{2}$–$2\frac{1}{2}$ poll. longa, 2–6 lin. lata. *Racemi* laterales, breves, 3–4-flori. *Bracteæ* ovatæ, acutæ, concavæ, 2–$2\frac{1}{2}$ lin. longæ. *Pedicelli* 8–10 lin. longæ. *Sepalum* posticum lineari-oblongum, apiculatum, 6 lin. longum ; lateralia lineari-oblonga, subfalcata, subacuta, 6 lin. longa. *Petala* anguste ovato-oblonga, subobtusa, vix 6 lin. longa. *Labellum* subintegrum v. obscure trilobum, ovatum, obtusum, 5 lin. longum, basi cuneatum, disco omnino villoso. *Columna* lata, 1 lin. longa. *Mentum* oblongum, latum, obtusum, 2 lin. longum.

BURMA ?

Flowered in the collection of H. Grose-Smith, Esq., The Priory, Ryde, I. of Wight, in March, 1898. Flowers bright yellow, with a number of red-brown streaks on the sides of the lip. The native country is not known with certainty, but it is reported to have been introduced with *Dendrobium Infundibulum*, which is only found in Burma.

205. **Bulbophyllum spectabile**, *Rolfe ;* ad *B. striatum*, Rchb. f., accedit, recedit floribus triplo majoribus et solitariis.

Rhizoma repens. *Pseudobulbi* ovoidei, nitidi, $\frac{1}{2}$–1 poll. longi, $4\frac{1}{2}$–9 lin. lati, monophylli. *Folia* elliptica, obtusa, coriacea, subsessilia, $1\frac{1}{4}$–$2\frac{1}{2}$ poll. longa, 7–12 lin. lata. *Scapi* breves, $2\frac{1}{2}$ poll. longi, uniflori. *Bracteæ* laxe tubuloso-spathaceæ, oblique truncatæ, 4 lin. longæ. *Sepalum* posticum ovatum, obtusum concavum, 1 poll. longum, 6 lin. latum ; lateralia similia, majora, circiter 1 poll. longa, 8 lin. lata. *Petala* ovato-oblonga, subobtusa, recurva, 9 lin. longa, $4\frac{1}{2}$ lin. lata. *Labellum* stipitatum, recurvum, carnosum, 7 lin. longum, 8 lin. latum, lobis lateralibus membranaceis rotundatis serrulatis, intermedio triangulari-oblongo subobtuso, apice lateraliter compresso, margine reflexo crenulato, disco obtuse bicarinato medio subconcavo. *Columna* brevissima, edentata, 2 lin. longa, pede 10 lin. longo.

ASSAM.

Flowered in the Royal Botanic Garden, Glasnevin, in May, 1896. Flowers pale green, closely spotted with deep brown, the spots being arranged in numerous lines.

206. **Eria (§Hymeneria) latibracteata,** *Rolfe*; ad *E. bractescentem*, Lindl., accedit, recedit bracteis multo latioribus et floribus majoribus.

Pseudobulbi ovoidei, 1–1¼ poll. longi, apice triphylli. *Folia* lanceolata v. oblongo-lanceolata, acuta, 2½–4½ poll. longa, 8–11 lin. lata. *Racemi* 3 poll. longi, puberuli, circa 7-flori. *Bracteæ* late elliptico-ovatæ, subacutæ, concavæ, 6–8 lin. longæ, 3½–6 lin. latæ. *Pedicelli* 4–6 lin. longi. *Sepalum* posticum ovatum, obtusum, concavum, 5 lin. longum, 3 lin. latum; lateralia late triangulari-ovata, subobtusa, leviter carinata, 5½ lin. longa, 5 lin. lata. *Petala* elliptica, subacuta, 5 lin. longa, 2½ lin. lata. *Labellum* trilobum, 5½ lin. longum, 5 lin. latum, lobis lateralibus semioblongis apice rotundatis, intermedio transverse oblongo obtusissimo v. repando, disco medio bilamellato nervo mediano leviter carinato. *Columna* clavata, 3 lin. longa. *Mentum* amplum, obtusum, 4 lin. longum.

BORNEO.

Introduced by Messrs. F. Sander & Co., with whom it flowered in July, 1895. Flowers pale whitish yellow, the petals veined with pale pink, and the side lobes of the lip maroon at the apex: bracts greenish yellow.

207. **Cœlogyne pulchella,** *Rolfe;* ad. *C. longipedem*, Lindl. accedit, recedit labelli apice obcordato-bilobo, carinis crenulatis, et floris colore.

Rhizoma validum. *Pseudobulbi* ovoideo-oblongi, vetusti circa 7-costati, 2½ poll. longi, 1 poll. lati, diphylli. *Folia* breviter petiolata, oblongo-lanceolata, acuta, subcoriacea, 5–5½ poll. longa, 1 poll. lata. *Scapi* terminales, 5–6 poll. longi, graciles, proliferi, sub racemis squamis distichis arcte vaginati. *Bracteæ* ovatæ, acutæ, cucullatæ, 5–6 lin. longæ, deciduæ. *Pedicelli* 6–7 lin. longi. *Sepala* ovato-oblonga, acuta, 6 lin. longa. *Petala* linearia, subacuta, 6 lin. longa. *Labellum* trilobum, 6 lin. longum, lobis lateralibus erectis semiovatis obtusis, intermedio late obcordato-bilobo undulato crenulato, disco tricarinato, carinis crenulatis intermedio brevioribus. *Columna* clavata, 3 lin. longa.

TROPICAL ASIA.

Introduced by Mr. J. W. Moore, Eldon Place Nursery, Bradford, with whom it flowered in March last. Flowers pure white, with the exception of a large sienna-brown blotch on the disc of the lip, which becomes darker on the keels, and a smaller blotch at the extreme base of the lip. The flowers of *C. longipes*, Lindl., its nearest ally, are yellow.

208. **Epidendrum (§Osmophytum) organense,** *Rolfe*; ad *E. calamarium*, Lindl., accedit, recedit planta duplo breviore, et foliis multo brevioribus.

Planta 2–2½ poll. alta. *Pseudobulbi* erecti, oblongi, monophylli (an semper?), 1–1¼ poll. longi. *Folia* elliptico-oblonga, obtusa, 1 poll. longa, ½ poll. lata. *Racemi* breves, erecti, pauciflori, ¾–1 poll. longi. *Bracteæ* lanceolato-oblongæ, acutæ, 1½ lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* oblongo-lanceolata, acuta, 4½–5 lin. longa, 1½–2 lin. lata. *Petala* lanceolata, acuta, 4½ poll. longa,

$1\frac{1}{4}$–$1\frac{1}{2}$ lin. lata. *Labellum* superum, 4 lin. longum, $2\frac{1}{2}$ lin. latum ; unguis columnæ adnatus ; limbus ovatus breviter acuminato-apiculatus, subconcavus, callo subcarnoso, late oblongo. *Columna* brevis, 3 lin. longa.

BRAZIL : Organ Mountains.

Introduced, among *Sophronitis grandiflora*, Lindl., by Messrs. F. Sander & Co., with whom it flowered in July, 1891. Sepals and petals dull yellow, the former much marbled and streaked with purple-brown at the back ; lip whitish with nine short dark purple radiating lines round the crest.

209. **Lycaste dyeriana**, *Sander ;* ad *L. Locustam*, Rchb. f., accedit, recedit habitu pendulo et foliis glaucis.

Pseudobulbi orbiculares, subcompressi, $1\frac{1}{2}$ poll. diam., diphylli. *Folia* pendula, lanceolata, acuminata, glauca, 6–8 poll. longa, 9–12 lin. lata. *Scapi* suberecti, uniflori, 4–5 poll. longi. *Bracteæ* spathaceæ, late elliptico-oblongæ, apiculatæ, glaucæ, 9–10 lin. longæ. *Sepalum* posticum lanceolato-oblongum, subacutum, $1\frac{3}{4}$ poll. longum, 7 lin. latum ; lateralia oblonga, acuta, obscure carinata, $1\frac{3}{4}$ poll. longa. 8–9 lin. lata. *Petala* oblongo-lanceolata, acuta, $1\frac{3}{4}$ poll. longa, 4–5 lin. lata. *Labellum* trilobum, circiter 1 poll. longum, 7 lin. latum, lobis lateralibus parvis erectis v. subincurvis obtusis, intermedio elliptico-oblongo obtuso convexo margine denticulato, disco canaliculato, callo spathulato marginibus tantum incrassatis apice obscure tridentato. *Columna* clavata, incurva, 8 lin. longa, alis auriculatis. *Mentum* conicum, obtusum, 4 lin. longum.

PERU.

Exhibited under the above name by Messrs. F. Sander & Co., at a meeting of the Royal Horticultural Society, on July 9th, 1895. Flowers green, with the exception of the column, which is white with a yellow stain at the base.

210. **Chondrorhyncha albicans**, *Rolfe ;* ad *C. lendyanam*, Rchb. f., accedit, recedit floribus multo minoribus.

Folia cæspitosa, breviter petiolata, lanceolato-oblonga, acuta, 3–4 poll. longa, 7–9 lin. lata. *Scapi* breves, 2 poll. longi, uniflori. *Bracteæ* ovatæ, acutæ, 2 lin. longæ. *Sepalum* posticum oblongum, acutum, 5 lin. longum, apice cucullatum, concavum ; lateralia falcato-oblonga, conduplicata, 7–8 lin. longa, apice incurva, acuta. *Petala* oblonga, obtusa, 5 lin. longa. *Labellum* late suborbiculari-ellipticum, obtusum, subundulatum, 9 lin. longum, 8 lin. latum, callo lato bilobo obtuso carnoso. *Columna* clavata, 4 lin. longa.

COSTA RICA.

Flowered in the collection of the Hon. Walter Rothschild, Tring Park, in June, 1896. Flowers white with a faint tinge of green in places.

211. **Sievkingia reichenbachiana**, *Rolfe ;* ad *S. fimbriatam*, Rchb. f., accedit, recedit labello fimbriato. petalis omnibus profunde fimbriatis.

Pseudobulbi ovoidei, vaginis scariosis amplis acutis vestiti, 9–14 lin. longi, monophylli. *Folia* petiolata, elliptico-lanceolata,

acuta, plicata, 4–5 poll. longa; petioli $\frac{3}{4}$–$1\frac{1}{4}$ poll. longi. *Scapus* pendulus, 2–$2\frac{1}{2}$ poll. longus, vaginis ovatis acutis vestitus, 4–5-florus. *Bracteæ* ovatæ, acutæ, nervosæ, 4 lin. longæ. *Pedicelli* 10–13 lin. longi, ut rachis bracteæque, minutissime nigro-verrucosi. *Sepala* ovata, integra, acuta v. acuminata, concava, 7–8 lin. longa. *Petala* oblonga, alte fimbriata, 7–8 lin. longa. *Labellum* superum, trilobum, fimbriatum, 6–7 lin. longum, lobis lateralibus falcato-divaricatis semiovatis, intermedio ovato-oblongo, disco apice bifurcato-appendiculato in sinu retrorse 5-dentato. *Columna* clavata, 6 lin. longa, pollinario hamato-appendiculato.—*Gorgoglossum reichenbachianum*, Lehm. in Gard. Chron., 1897, xxi, p. 346, *in nota.*

ECUADOR: Western Andes, 1000 to 2000 ft. *Lehmann.*

This flowered in the collection of Sir Trevor Lawrence in 1896. Sepals pale yellow, and the deeply-fringed petals and lip deep yellow, with many red-purple spots at the base of the latter.

212. **Stanhopea impressa,** *Rolfe; ad S. inodoram,* Lindl., accedit, recedit hypochilio subtus prope apicem impresso.

Pseudobulbi conico-ovoidei, $2\frac{1}{2}$–3 poll. longi. *Folia* petiolata, elliptico-oblonga, breviter abrupteque acuminata, $\frac{3}{4}$–$1\frac{1}{4}$ poll. longa; petioli $2\frac{1}{2}$–3 poll. longi. *Scapi* penduli, circa 6 poll. longi, 4-flori. *Bracteæ* ovato-oblongæ, subacutæ, involutæ, $1\frac{3}{4}$–$2\frac{1}{4}$ poll. longæ. *Pedicelli* 2–$2\frac{1}{4}$ poll. longi. *Sepalum* posticum elliptico-oblongum, apiculatum, $2\frac{1}{4}$ poll. longum; lateralia oblique semiovato-oblonga, apiculata, $2\frac{1}{4}$ poll. longa. *Petala* elliptico-oblonga, apiculata, 2 poll. longa. *Labellum* trilobum, 2 poll. longum; hypochilio late oblongo subtus prope apicem impresso lateribus bicarinatis angulis ante basin rotundatis v. obscuris ore obovato-oblongo, canali clauso, mesochilii cornubus incurvis oblongo-lanceolatis acutis, epichilio late suborbiculari apiculato. *Columna* $1\frac{3}{4}$ poll. longa, ad medium late alata, alis late triangularibus subobtusis.

WESTERN ANDES OF S. AMERICA.

Flowered in the collection of the Hon. Walter Rothschild, in June, 1896. Flowers fragrant, light buff yellow with a few traces of purple spotting on the sepals and petals, and the base of the lip orange-yellow.

213. **Maxillaria elegantula,** *Rolfe; ad M. grandifloram,* Lindl., accedit, recedit floribus coloratis maculatis, labello apice trilobo lobo intermedio crasse carnoso subrecurvo.

Folia oblongo-lanceolata, acuta, 11 poll. longa, 20 lin. lata, basi angustata, conduplicata. *Scapi* 8 poll. longi, vaginis spathaceo-lanceolatis acutis carinatis laxis subimbricatis vestiti. *Bractea* spathaceo-lanceolata, acuta, carinata, $1\frac{1}{2}$ poll. longa. *Sepala* $1\frac{1}{2}$–$1\frac{3}{4}$ poll. longa, posticum lanceolato-oblongum, acutum, leviter carinatum, lateralia triangulari-oblonga, acuta, subfalcata. *Petala* triangulari-oblonga, acuta, subfalcata, $1\frac{1}{4}$–$1\frac{1}{2}$ poll. longa. *Labellum* obovato-oblongum, 10–12 lin. longum, apice trilobum, lobis lateralibus leviter crenulatis, intermedio crasse carnoso subrecurvo, disco copiose farinaceo medio callo transverso obtusissimo instructo. *Columna* crassa, 6 lin. longa. *Mentum* late conicum, 7 lin. longum.

Peru or Ecuador.

Introduced by Messrs. F. Sander & Co., and flowered in their establishment in October last. Sepals nearly white at the base, brown-purple towards the apex, and spotted with dark purple-brown; lip yellow, margined with purple at the base.

214. **Maxillaria dichroma,** *Rolfe*, ad *M. venustam*, Lindl., accedit, recedit floribus multo minoribus.

Folia oblongo-lanceolata, acuta, 11–12 poll. longa, 20 lin. lata, basi angustata, conduplicata. *Scapi* 6 poll. longi, vaginis spathaceo-lanceolatis acutis carinatis laxis subimbricatis vestiti. *Bractea* spathaceo-lanceolata, acuta, carinata, 18 lin. longa. *Sepala* 1½ poll. longa, posticum lanceolato-oblongum, acutum, leviter carinatum, lateralia triangulari-oblonga, acuta, subfalcata. *Petala* triangulari-oblonga, acuta, subfalcata, 1–1¼ poll. longa. *Labellum* obovato-oblongum, 7–9 lin. longum, apice obscure trilobum, lobis lateralibus subrepandis, intermedio rotundato apiculo recurvo instructo, disco copiose farinaceo medio callo transverso obtusissimo instructo. *Columna* crassa, 4 lin. longa. *Mentum* late conicum, 7 lin. longum.

Peru or Ecuador.

Introduced by Messrs. Sander & Co., of St. Albans. Flowers white, with the basal half of the petals veined and suffused with light purple; lip margined with the same colour. An albino of the species has since flowered at St. Albans. This and the preceding species were introduced together with *Maxillaria sanderiana*, Rchb. f.

215. **Trichocentrum alatum,** *Rolfe*; ad *T. fuscum*, Lindl., accedit, recedit floribus minoribus, petalis et labello multo latioribus.

Pseudobulbi suborbiculari-oblongi, 2–3 lin. longi. *Folia* lineari-oblonga, acuta, canaliculata, valide carinata, 3¼ poll. longa, 3–3½ lin. lata. *Pedunculi* breves, uniflori. *Bracteæ* lanceolato-ovatæ, acutæ, 3 lin. longæ. *Pedicelli* triquetro-alati, 10–12 lin. longi. *Sepala* lanceolato-ovata, acuta, subcarinata, 7 lin. longa, 2½ lin. lata. *Petala* obovato-oblonga, obtusa, 6½ lin. longa, 3½ lin. lata. *Labellum* orbiculari-obovatum, retusum, longe calcaratum, 8 lin. longum, 6½ lin. latum. *Calcar* 10 lin. longum, attenuatum. *Columna* lata, 1½ lin. longa, alis late oblongis subintegris.

Colombia: *Millican*.

Flowered in the collection of Sir Trevor Lawrence, Bart., in June, 1895. Flowers white, except the basal two-thirds of the lip, which is deep yellow with seven light red veins along the centre, and the spur, which is yellowish.

216. **Oncidium (§Rostratæ) gracillimum,** *Rolfe*; ad *O. luteum*, Rolfe, accedit, recedit labello multo angustiore bifido.

Pseudobulbi ovoideo-oblongi, subcompressi, 3 poll. longi, 1¼ poll. lati, apice diphylli. *Folia* lineari-lanceolata, acuta, 7–8 poll. longa, 11 lin. lata. *Panicula* ampla, ramosissima, 3 ped. longa; rami graciles, 6–9 poll. longi. *Bracteæ* lanceolato-oblongæ, acutæ

$1\frac{1}{4}$–$1\frac{1}{2}$ lin. longæ. *Pedicelli* 4–5 lin. longi. *Sepala* libera, spathulata vel oblanceolata, vix obtusa, 3–$3\frac{1}{2}$ lin. longa, 1 lin. lata; lateralia basi approximata. *Petala* spathulato-oblonga, obtusa, $2\frac{1}{2}$ lin. longa, $1\frac{1}{4}$ lin. lata. *Labellum* trilobum, 4 lin. longum; lobi laterales oblongi, obtusi, divaricati, $1\frac{1}{2}$ lin. longi, 1 lin. lati, intermedio oblongo v. obovato-oblongo, $2\frac{1}{2}$ lin. longo, $1\frac{1}{2}$ lin. lato, apice bifido, segmentis obtusis v. truncatis; crista 6-loba. *Columna* 2 lin. longa, recurva, basi in processum carnosum producta, alis oblongis apice inæqualiter tridenticulatis, dente postico falcato-recurvo, rostello rostrato elongato 1 lin. longo.

PERU.

Flowered in Messrs. F. Sander & Co.'s nursery in April, 1896. Flowers yellow, with a few very pale brown markings at the base of the sepals and petals and around the crest.

217. **Sarcanthus hongkongensis,** *Rolfe*; ad *S. filiformem*, Lindl., accedit, recedit floribus minoribus, calcare inflato-oblongo.

Planta 1 ped. alta. *Folia* teretia, subobtusa, recurva, 3–4 poll. longa, 1–$1\frac{1}{2}$ lin. lata. *Racemi* axillares, graciles, arcuati, 5 poll. longi, multiflori. *Bracteæ* minutæ, ovato-lanceolatæ, acutæ. *Pedicelli* 2–3 lin. longi. *Sepalum* posticum late elliptico-oblongum, obtusum, concavum, 1 lin. longum; lateralia plana, paullo longiora. *Petala* elliptico-oblonga, obtusa, 1 lin. longa, sepalis paullo angustiora. *Labellum* trilobum, 1 lin. longum, lobis lateralibus oblongis subobtusis, intermedio triangulari obtuso. calcare inflato-oblongo 1 lin. longo. *Columna* brevissima.

HONGKONG: *Ford.*

Flowered at Kew in June, 1893. Flowers pale lilac, with the column and front of the lip bright purple.

218. **Jenmania,** *Rolfe* (gen. nov.). *Perianthium* connivens. *Sepala* et *petala* subæqualia. *Labellum* petalis multo latius, obsolete trilobum, facie inferne columnæ basi adnatum, marginibus eumdem amplectens; disci nervæ vix incrassatæ, parce villosæ. *Columna* subelongata, paullo arcuata, labello semiadnata, apice biauriculata; stigma ad basin rostelli lati transverse concavum; clinandrium breve. *Anthera* incumbens, apiculata, bilocularis; pollinia . . . . *Capsula* elongata, teres, columna persistente coronata.—*Herba* elata, terrestris, habitu *Neuwiediæ*. *Flores* mediocres, in paniculam laxam dispositi. *Bracteæ* amplæ.

J. elata, *Rolfe* (*sp. unica*).

Herba terrestris. *Folia* radicalia v. subradicalia, longe petiolata; limbus lanceolatus, acuminatus, plicatus, 1–$1\frac{3}{4}$ ped. longus, $1\frac{3}{4}$–$3\frac{1}{2}$ poll. latus; petiolus $\frac{1}{2}$–$1\frac{1}{4}$ ped. longus, basi vaginatus. *Scapus* ad 4 ped. altus, vaginis imbricatis tectus, apice laxe paniculatus; rami 4–8 poll. longi, racemosi. *Bracteæ* amplæ, ovatæ v. ovato-oblongæ, acutæ v. mucronatæ, concavæ, venosæ, scaberulæ, 7–11 lin. longæ. *Flores* flavi. *Pedicelli* 6 lin. longi. *Sepala* oblanceolata, apiculata, 12–13 lin. longa, 3 lin. lata. *Petala* sepalis paullo angustiora. *Labellum* obscure trilobum, 1 poll. longum, expansum 6–5 lin. latum, basi angustum. *Columna* 7 lin. longa. *Capsulæ* elongatæ, $1\frac{1}{2}$–$1\frac{3}{4}$ poll. longæ.

TRINIDAD: *Prestoe.* BRITISH GUIANA: Pomeroon River, *Jenman*, 1640; Demerara River, *Jenman*, 6904.

A remarkable orchid allied to *Corymbis*, but among other characters distinguished by the narrowed base of the lip being adnate to the column for half the latter's length, the incumbent, not erect, anther, and the long-petioled radicle leaves, recalling those of *Neuwiedia*. It is also near *Palmorchis*, Rodr., which, however, according to the original drawings and description, has a reed-like habit, something like *Sobralia*, and a three-lobed lip which is shorter than the column, besides some differences in the latter. A plant sent by Mr. Prestoe from Trinidad flowered at Kew in September, 1870, but has since been lost sight of; and since then good specimens have been collected in British Guiana by Mr. Jenman. Living plants would again be acceptable, as the structure of the anther and stigma are difficult to decipher after being pressed and dried. The genus is dedicated to Mr. Jenman.

219. **Sobralia luteola,** *Rolfe;* ad *S. suaveolentem*, Rchb. f., accedit, recedit floribus breviter racemosis, labello subintegro.

Caules glabri, 1–3 ped. alti. *Folia* oblongo-lanceolata, subacuminata, plicata, 4–7 poll. longa, $1\frac{1}{4}$–$1\frac{3}{4}$ poll. lata. *Flores* in racemos congestos dispositi. *Bracteæ* subdistichæ, imbricatæ, ovato-oblongæ, subacutæ, glabræ, 3–6 lin. longæ. *Pedicelli* 1 poll. longi. *Sepala* et *petala* oblongo-lanceolata, subacuta, $1\frac{1}{2}$ poll. longa, 4 lin. lata, sepalis lateralibus carinatis. *Labellum* fere integrum, oblongum, obtusum v. emarginatum, crispato-crenulatum, $1\frac{1}{4}$ poll. longum, 8 lin. latum, disco 7-nervo, nervis fimbriato-pilosis. *Columna* clavata, 9 lin. longa, dentibus falcato-oblongis.

TROPICAL AMERICA.

Flowered in the collection of Pantia Ralli, Esq., Ashtead Park, Epsom, in March, 1896. Flowers light yellow with rather darker nerves on the lip, and a few traces of brown between the keels in front.

220. **Hetæria samoensis,** *Rolfe;* ad *H. Whitmeei*, Rchb. f., accedit, recedit foliis latioribus, bracteis longioribus.

Caulis repens. *Folia* petiolata, elliptico-oblonga, acuta v. brevissime acuminata, membranacea, $3\frac{1}{2}$–4 poll. longa, $1\frac{3}{4}$–2 poll. lata; petiolus 1–2 poll. longus, basi laxe vaginatus. *Scapus* erectus, pubescens, 1–$1\frac{1}{4}$ ped. altus. *Racemus* 3 poll. longus. *Bracteæ* anguste ovato-lanceolatæ, acuminatæ, concavæ, pubescentes, 4–6 lin. longæ. *Sepala* libera, ovata, vix obtusa, concava, 2 lin. longa. *Petala* oblonga, obtusa, 2 lin. longa. *Labellum* superum, ovatum, subobtusum, 2 lin. longum, basi ventricosum, fimbriato-villosum. *Columna* brevis, margine inferiore bibrachiata.

SAMOA: *Walter.*

Described from a specimen in the Cambridge University Herbarium, collected in 1875. The flowers are rather old, and the pollinia missing; the arms at the base of the column have almost the shape of the anther case, though slightly shorter, but whether this is the normal condition is uncertain.

DCXXI.—MISCELLANEOUS NOTES.

MR. EDOUARD LUJA, a member of the gardening staff of the Royal Gardens, has been appointed by the Government of the Congo Free State Botanical and Entomological Collector in the upper regions of that country. He leaves for Africa in the present month.

The Library Association.—On July 11th a number of members of this Association visited Kew for the purpose of inspecting the library of the Royal Gardens. The visit was arranged by Mr. F. Turner, Librarian of the Brentford Free Library, and the visitors were received by the Director and Herbarium staff, and conducted through the various apartments of the library. A programme of the afternoon's proceedings, prepared by Mr. Turner, contains a photographic view of the interior of the room of the Keeper of the library.

Botanical Magazine for July.—*Coelogyne swaniana* was imported from the Philippine Islands by Messrs. Sander & Co., who sent a plant to the Royal Gardens in 1892. It closely resembles *C. dayana. Callianthemum rutæfolium* var. *anemonoides*, native of Styria, flowered at Kew in March, 1897. *Iris Grant-Duffii* is a distinct new species from Palestine. It was first collected in 1864 by Mr. B. T. Lowne on the banks of the River Kishon, and again by Sir M. E. Grant-Duff in the Plain of Esdraelon. The drawing was made from a plant which flowered in the garden of W. E. Gumbleton, Esq., of Queenstown. *Eria latibracteata* is a new species imported from Borneo by Messrs. Sander & Co., by whom the plant figured was sent to Kew, where it flowered in July, 1897. The Californian *Calochortus clavatus* has lately been introduced into cultivation by Mr. Carl Purdy, of Ukiah, California, and is one of the finest species for the garden. The plant drawn flowered at Kew in June, 1897.

Flora Capensis.—Part II. of Vol. VII. was issued during the past month. It contains the completion of the elaboration of the *Cyperaceæ*, by Mr. C. B. Clarke, F.R.S., and the commencement of that of the *Gramineæ*, by Dr. Stapf, who worked in collaboration with Sir Joseph Hooker on the same order for the Flora of British India.

Queen's Cottage Grounds.—H.M. the Queen has directed that access to these grounds (37·397 acres in extent) shall be given to the public. The First Commissioner made the following statement with regard to them in Parliament :—

"The Queen's Cottage had been handed over by Her Majesty for the enjoyment of the public. . . . It was the intention of

the Office of Works to preserve the grounds as far as possible in their present condition. They would only open a path from Kew Gardens to the cottage. The rest would remain much in its present condition. It would not be cut up unnecessarily, and it should still form one of the most beautiful bits of wild country in the proximity of London, and be, as it certainly had been, a great sanctuary of all bird life in the district."—(*Times*, April 19.)

The "formal" addition of this precinct to the Royal Gardens took effect from May 21st. But public access cannot be given till provision for its maintenance and supervision has been made in the estimates for the next financial year.

New Offices.—The business offices of the Royal Gardens have for many years occupied extremely cramped accommodation adjoining the Curator's house on Kew Green. During the past month they have been removed to more convenient quarters in Descanso House (No. 181, Kew Road), adjoining the "Melon Ground," the principal workyard of the establishment. The upper part of the house has been fitted up as a residence for the Assistant Curator.

Descanso House was for a considerable period the official residence of the Director during the time that the establishment was in Royal occupation. When W. T. Aiton, Director-General of the Royal Gardens at Kew and elsewhere, retired in 1841 he was allowed to retain his residence, West Park being rented by the Government for the new Director of Kew, Sir W. Hooker. On Mr. Aiton's death in 1849, Descanso House was let by the Office of Works on a yearly tenancy. A vacancy having occurred, the Board has resumed possession, and devoted it to official purposes, the adjoining garden being thrown into the principal workyard, and a new workmen's and goods entrance constructed.

Gardeners' Reading Room.—Kew is, amongst its other functions, a school of advanced horticulture. In 1848 the Office of Works devoted to the use of the young gardeners as a reading-room in the evening a portion of the building now used as a Director's office. In 1860 a new room for this purpose was added, which has remained in use till the present year. The accommodation had, however, long become altogether insufficient for the number of gardeners employed, which now amounts to some fifty.

Fortunately, a large room adjoining Descanso House was available, and this the Office of Works has adapted to the purpose. Two small rooms adjoining serve as a cloak-room and lavatory.

Bronze relievi.—Nothing seems to be known as to the origin of the name Descanso House. According to a statement in the *Proc. Linn. Soc.* (May 24, 1850, p. 83), it "was built expressly" for W. A. Aiton, the first Director of Kew, by George III. The large room referred to above, which adjoins it on the west, was apparently intended as a kind of summer dining-room for the use of the King

when visiting the Kitchen Gardens. The walls of the interior were decorated with five large bronze *relievi*, which had apparently long been lost sight of. The attention of Sir John Robinson, the Surveyor of the Pictures to Her Majesty, was drawn to them, and as the result of his report, the Office of Works decided upon their removal.

Sir John Robinson gave the following account of them in the *Times* for June 4th. He, however, fell into an error in stating that they were contained in Kew Palace.

"TO THE EDITOR OF THE TIMES.

"SIR,

"PENDING the discovery of the original locality and reason of being of the historical monument of which these relievi doubtless formed an integral part, it will perhaps be not uninteresting to give a brief account of the subjects which they represent.

"This, as I expected, has required very little research.

"The identification of the bronzes has shown, in the first place, that they illustrate several distinct events and not a single occurrence, and, in the next, that the date of their production must be put somewhat later than I had thought to be the case—namely, shortly after 1687 rather than 1680.

"The earliest subject in point of date, which we may call No. 1, doubtless refers to the quarrel of Louis XIV. with the Pope Alexander VII., on account of the affray at the French Embassy in Rome with the Pope's Corsican guard, which served as a pretext for the seizure of Avignon (1662).

"This is the subject in which the erection of a pyramid is seen in the background.

"No. 2 is the relievo in which are the arms of Sweden on a banner, and in which one of the personages has the Danish Order of the Elephant.

"This illustrates the overruling by Louis of the Elector of Brandenburg and the King of Denmark, in favour of his ally, the King of Sweden, at the Peace of Nimeguen (1679).

"No. 3 apparently represents the submission of the Republic of Genoa, when the Doge and four of the leading Senators were sent as suppliants to Versailles (1685).

"Nos. 4 and 5 I have no doubt have reference to the further quarrel with Rome, touching the territorial pretensions of the French Embassy, and are episodes of the same event (1687).

"It is on record, though at the moment, not having the means of reference at hand, I cannot particularize, that a relievo, which must have been similar in character to the present ones, the subject of which was the reception of the pseudo-Siamese Embassy by the King, was inserted into the pedestal of a statue of Louis XIV., and I have, in fact, an impression that the bronze is still extant. As the date of the Siamese Embassy was 1684, it seems not improbable that it may be a missing relievo from the present series.

"Succinct accounts of all these transactions will be found in Voltaire's 'Siècle de Louis Quatorze.'

"I am, Sir,

"Your obedient servant,

"107, Harley Street, June 1st. "J. C. ROBINSON."

Pelicans.—The fine birds received from Admiral Blomfield in December last (*Kew Bulletin*, 1898, p. 25) are now believed to be *Pelicanus onocrotalus*, not, as then stated, *P. crispus*. In May last two further pelicans were received at Kew through Mr. T. L. F. Beaumont, Chairman of the Gardens Committee at Karachi. These are believed to be *Pelicanus mitratus*.

Bamboo brooms.—An addition to the collection of bamboo products exhibited in Museum No. 2 of the Royal Gardens has recently been made by Mr. J. H. Hart, Superintendent of the Botanic Garden, Trinidad, who sends some convenient sized hand brooms made entirely from the stems of what is apparently *Bambusa vulgaris*. In the preparation of these brooms the outer portion of the stem is split down, then beaten into a fibrous state, turned back, and tied down with string, leaving the central and naked portion of the stem to form the handle. The brooms illustrate a very simple but useful application of bamboo stems.

Artemisia pallens.—Mr. G. Marshall Woodrow, Professor of Botany, Poona, has communicated to the Herbarium a number of specimens of an *Artemisia* which is, he states, cultivated in the Bombay Presidency and used as an offering at the Ramnavam festival. He suggested that it might be Wallich's *Artemisia pallens* (Cat. 3302), a very obscure plant, which is enumerated in Hook. f. *Fl. Brit. India*, iii., 329, among the dubious species. Comparison with Besser's description in his monograph of the section *Abrotanum* of *Artemisia* (in *Nouv. Mém. Soc. Nat. Mosc.*, iii. (1834), 85)—which description was drawn up from Wallich's specimens—left hardly any doubt as to its identity with that species, and this was further confirmed by comparison with the originals in the Wallichian Herbarium at the Linnean Society by Mr. C. B. Clarke. Wallich got his specimens from the Madras Herbarium and from Heyne; but there is no evidence where they were collected. Wight mentions *A. pallens* in his *Contributions*, p. 20, and he distributed specimens of it under No. 1463, with the note "Wall. 3302." The specimen in Kew, to which a label is attached bearing the name *Artemisia pallens*, Wall., in A. P. De Candolle's handwriting, has rather smaller heads than Woodrow's examples, and is in a more advanced state, but otherwise agrees perfectly with them. In looking through the collection of drawings at the Kew Herbarium I came across Roxburgh's unpublished figure of his *Artemisia paniculata*, and was at once struck by the great resemblance of it with Wight's specimen. A closer examination of the drawing and of Roxburgh's description (*Fl. Ind.*, iii., 418) of this plant convinced me of the identity of *A. pallens* and *A. paniculata*, Roxb. (not of Lam. nor of Rottl.). Roxburgh mentions the name in his earlier *Hort. Beng.* 61 (1814), indicating Persia as the native place, and a Mrs. Honeycomb as the donor. In his *Flora Indica*, edited by Carey, however, he says: "The native place of this plant I cannot well ascertain. It was introduced into the Botanic Gardens from the interior parts

of Bengal." *A. paniculata*, Roxb., was referred to *A. vulgaris*, L., in *Fl. Brit. Ind.*, iii., 325, probably on the strength of the fact that a specimen from Bombay being named *A. paniculata* in the Kew Herbarium actually is *A. vulgaris*. Thus, the question as to the origin of the plant was unsolved so far. Sir Joseph Hooker suggested that Wallich's examples were from a garden, and so are Woodrow's; but what is then the native country of *A. pallens?* *Artemisia* is an essentially boreal genus. The only species found in a wild state in the Dekkan Peninsula are *A. parviflora*, Roxb., and *A. vulgaris*, Linn., both very different from *A. pallens*. On the other hand, there are numerous species in the temperate regions of Europe and Asia and of North Africa. Of those only the section *Abrotanum*, numbering over 50 species, comes into consideration. Besser (*l.c.*) and De Candolle (*Prod.* vi. 120) have already stated that *A. pallens* is a rather aberrant type of the section *Abrotanum*, showing no distinct affinity towards any of the other species, on account of the particular structure of the involucre. This is, no doubt, true, in so far as the relative size of the involucral bracts is concerned, the outer bracts being as long as or longer than the inner; but taking the plant as a whole, I believe that the affinity lies distinctly with *A. judaica*, Linn., a suffrutescent species inhabiting Lower Egypt and the Sinai Peninsula. The native country of *A. pallens* might therefore be sought for rather in the Orient than in the Himalayas or in Central Asia. This hypothesis is further supported by Roxburgh's original indication that the plant was of Persian origin and by a curious statement in Dymock's *Materia Medica of Western India*, 2nd ed., 435. Speaking of *A. sieversiana*, Willd., he says: "The drug current in Bombay is derived from the plant at the head of this article; it is imported from Persia, and has for many years been cultivated at Bandora, in the neighbourhood of Bombay, for the sake of the fresh herb, which is always obtainable in the market, and is much valued by the Hindus. The cultivation appears to have been in the hands of a few Christian families for several generations; they also cultivate Sweet Marjoram. The two plants are called *Azarona* and *Mázarona* by the native Christians, and were no doubt introduced into the country by the Portuguese." Now, *A. sieversiana* does not grow in Persia; but it has, although belonging to a different section of *Artemisia*, a considerable external resemblance to *A. pallens*, and a confusion of the two species might easily occur. Indeed, Dymock quotes the very same vernacular name, *i.e.*, "*downa*," for his *A. sieversiana*, which Mr. Woodrow gives for *A. pallens*, and, moreover, his description of the plant agrees very well with *A. pallens* in most respects, particularly when he says "the flower heads globose, as large as a pea, stalked, nodding; involucres scarious; odour camphoraceous and very aromatic." I have therefore very little doubt that at least a part of Dymock's *A. sieversiana*, namely, the fresh herb sold as *downa* in the Bombay markets, is *A. pallens*, and that, if it was really introduced by the Portuguese or at the time of the Portuguese ascendency in the East, it came from the Persian Gulf. Graham (*Pl. Bomb.*, 102) mentions also a species of *Artemisia* as cultivated in gardens near Bombay. He calls it *A. Abrotanum*; but as there is no other evidence of this species occurring in India, either in a cultivated or a spontaneous form,

I suspect that Graham's plant was also *A. pallens.* Finally, I might point out that the name "*downa*" occurs in Ainslie's *Mat. Med. of Hindoost.* (1813), 44, 161, as the Dekkani name of an *Artemisia* which is "one of the many sweet smelling shrubs that are strewed before the Hindoo gods at religious ceremonies," and "an offering at the shrines of Sheva and Vishnoo." He refers it to *A. austriaca*, L., a synonym of which is *A. orientalis*, Willd., the name Wallich found attached to the specimens of *A. pallens* in the Madras Herbarium. That this name found its way into the Madras Herbarium is not surprising if we consider that the Madras botanists of that time were, through Rottler, the most prominent among them, in communication with Willdenow. Dalzell and Gibson in their *Bombay Flora* do not mention *A. pallens;* but they attribute the word *downa* to *A. indica* (*A. vulgaris*, L., according to *Fl. Brit. Ind.*, iii., 325), a plant which Ainslie enumerates also, but under different vernacular names. Other vernacular names of the plant are: "*maritolundoo*" (Tamil) and "*dawanum*" (Telingu) according to Ainslie, l.c., and "*dawana-kaha*" (Sanskrit) according to Piddington (*Engl. Ind. Pl. Ind. s.*).

O. Stapf.

Annals of the Royal Botanic Garden, Calcutta.—The eighth volume of this work has just reached this country. It is entirely devoted to the description and illustration of the orchids of the Sikkim-Himalaya, by Sir George King, late Superintendent of the Royal Botanic Gardens, Calcutta, and Robert Pantling, Deputy-Superintendent of the Cinchona plantations at Mungpoo. Each succeeding volume of the *Annals* exceeds its predecessor in size, and the eighth is truly monumental, consisting of 342 quarto pages of letterpress and 448 plates. Fortunately the matter has been arranged for binding in four parts; one of letterpress and three of plates. It is not easy to convey an idea of the immense amount of labour put into this addition to orchid literature, and much of it was done under great difficulties. The drawings were all executed by Mr. Pantling, and, with very few exceptions, from living plants. They are not merely representations of the plants; they also contain a great amount of botanical detail that could only be satisfactorily reproduced from living plants. The drawings, we are informed in the preface, were all lithographed by natives of Bengal, educated at the Government School of Art in Calcutta. And the colouring was done, under Mr. Pantling's supervision, by the sons of Nepalese coolies employed in the Government Cinchona plantations—boys who had never, until Mr. Pantling took them in hand, been accustomed to any implement more delicate than a hoe. Sir George King adds: "Mr. Pantling's perseverance and skill in drilling these boys into accurate colourists has been a standing marvel to everybody who has seen them at work." As might be expected, the plates are not equal in every respect to the best European work, though for botanical purposes they are infinitely better than many produced in this country. The authors are to be congratulated on the successful completion of their gigantic undertaking; and the liberality of the Government of Bengal in defraying the cost of its publication cannot be

too highly applauded. The value of the work is greatly enhanced by the fact that twelve sets of dried specimens of the orchids described and figured have been prepared and presented to as many of the leading botanical establishments of the world.

Natal Plants.—The first part has reached Kew of a quarto publication illustrating the flora of Natal. Its title is: *Descriptions and Figures of Natal Indigenous Plants with Notes on their Distribution, Economic Value, Native Names*, &c., &c. It is the joint work of Mr. J. Medley Wood, Curator of the Botanic Gardens, Durban, and Mr. M. S. Evans, M.L.A.; and is, we believe, the first illustrated botanical book entirely produced in South Africa. Both Mr. Wood and Mr. Evans have long been contributors to the Kew Herbarium, where their plants have been identified or compared. In every way the enterprise is deserving of commendation; and it is to be hoped that the authors' object of awakening a wider interest in the vegetable productions of their adopted country will be attained. The present part consists of forty-one pages of letterpress and fifty lithographed plates, representing as many different plants. Should the authors meet with sufficient encouragement, they will continue the work. It is satisfactory to note that the liberality of the Natal Government will protect the authors from the risk of any serious financial loss.

Lemon Grass Oil.—*Andropogon Nardus*, *L.*, has been largely cultivated in Ceylon and Singapore for the production of this volatile oil, which has an "odour strongly resembling the sweet-scented verbena or lemon plant of our gardens." It has some reputation in India for medicinal purposes.

According to the following information its production and that of similar oils seems to have fallen into some neglect in the Straits Settlements:

EXTRACT from letter from Director, Gardens and Forest Department, Singapore, to Royal Gardens, Kew, dated February 16, 1898.

"The decay of the Lemon-grass oil trade in Singapore has attracted my notice, and I am writing a few lines to try and stir up the cultivation again. It was chiefly, I believe, produced by one man, who had a distillery for citronella, lemon-grass, &c., a little way outside Singapore. He died a few years ago, and I fear the whole business is diminishing. I hope it may revive and that others will take these oils up. There is nothing more in the industry than ordinary distillation of anything procurable that will produce a saleable oil. With citronella, lemon-grass, vetiver, patchouli, (pepper oil, a supposed native specific for cholera, had a great run during the cholera scare, it was a perfectly awful beverage I believe), Cajuput, *Cananga*, *Blumea balsamifera*, *Cassia*, clove, nutmeg, *Ocimum*, camphor, *Artabotrys* and a lot of other things might also be tried by an energetic distiller. The natives would buy them if no one else did."

Ipecacuanha in the Straits Settlements.—The first commercial sample of this drug produced in the Old World found its way into the London market in 1887 (*Kew Bulletin*, 1888, p. 128). Johore was, it was believed, the source of the consignment. Nothing has been heard of it till the receipt during the present year of the following information :—

Extract from letter from Director, Gardens and Forest Department, Singapore, to Royal Gardens, Kew, dated February 16, 1898.

"I thought that the cultivation of Ipecacuanha here had gone out, but one of our best planters tells me he has not only got a very fairly extensive garden of it, but is going on on a much larger scale. It was formerly cultivated by him at Pengerang, in Johore, but it has been moved to Selangor, where it grows well and pays too, as he gets full price of 10s. per lb."

Hybrid Coffee.—A note on hybrid coffee in Mysore was recently published in the *Kew Bulletin* (1898, p. 30). According to the *Tropenpflanzer* (1898, p. 164), Dr. Burk has recorded a similar hybridization of Arabian and Liberian coffee in Java. The results in that island are, however, not considered so favourable as in Mysore. In Java the hybrid plants are said to yield very sparingly, while some are quite barren. Herr F. von Braun is quoted as stating that "of the many hundred hybrid plants in the experimental gardens at Tjikeumeuh, near Buitenzorg, a few only produce fruits." On the other hand, grafted plants (Arabian coffee on Liberian coffee) are said to be very promising.

Hybrid coffee plants appear to have been also produced in the West Indies, but nothing is stated as to their productiveness.

Extract from letter from Curator, Botanic Station, Dominica, to Royal Gardens, Kew, dated June 8, 1898.

'I noticed in the *Kew Bulletin* a note on hybrid coffee in Mysore. It will interest you to hear that there is a coffee grown in Martinique which is said to be a hybrid between the Arabian and Liberian kinds. A gentleman here obtained a small plant of it for me, and I am now growing it at this Station. The leaves of my small plant are as large as the leaves of Liberian coffee, but in appearance they are similar to the leaves of Arabian coffee, and like the latter are badly attacked by the coffee fly."

Florida Velvet Bean.—Under this name a leguminous plant has been prominently recommended in American journals as a forage plant and as admirably adapted for green crop manuring. Recently the beans have been offered for sale in this country. As frequent references have been made to Kew, it is desirable to place on record what is known of the plant and its capabilities. As to its identity, it was from the first conjectured that the seeds belonged to a plant very near the common purple-flowered Cowhage or Cow-itch plant of the tropics, *Mucuna pruriens*. The difficulty, in the absence of adequate specimens, in identifying it with this

was the fact that in the Cow-itch plant the pods are densely covered with stinging hairs of a brownish colour. A plant so formidably armed, it was thought, could not safely be recommended for general cultivation. The name first given, *Dolichos multiflorus* (Dioclea Boykinii), was clearly wrong. In these circumstances we are glad to find from the *Queensland Agricultural Journal*, vol. ii., pp. 370–371 (with a plate), that the plant has flowered and fruited in that colony, and that Mr. F. M. Bailey, F.L.S., the Colonial Botanist, has identified it as *Mucuna pruriens*, var. *utilis*. In this variety of the Cow-itch plant the pods are apparently devoid of stinging hairs. It is probably *M. utilis* of Wall., described in the *Flora of British India* (vol. ii., p. 187), as "a cultivated variety" with velvety not hairy pods. This is figured in *Wight's Icones* (vol. i., t. 280). According to Watt's *Dictionary of the Economic Products of India*, "the young tender pods are cooked and eaten as a vegetable." What may also prove to be the same plant, with jet black seeds, is cultivated as a rotation crop on sugar estates in Mauritius, under the name of "Pois Mascate." The accounts given by interested parties in America respecting the agricultural value of the Florida velvet bean, must be received with caution. It is undoubtedly a rapid grower and affords a large yield of nutritious forage. It bears an abundant crop of seed and is therefore readily propagated. It may also, in common with many other leguminous plants, possess the power of obtaining its nitrogen from the atmosphere, and thus be admirably adapted for green crop manuring. How far it may be found superior in these respects to other plants it is impossible to say. As it is now being carefully tested in various parts of the tropics, it would be well to await reports which will, no doubt, be shortly issued on the subject.

Meanwhile it may be useful to mention some of the more prominent leguminous plants that have long been used in tropical countries, both eastern and western, as rotation crops for fodder and green manuring : (1) *Vigna Catiang*, the Chowlee of India, the Tow Cok of China and the Cow pea of the West Indies ; of this there are several varieties with black and clay-coloured seeds : (2) *Cajanus indicus*, the Pigeon pea (the small form is known as the No-eye pea and the large as Congo pea) ; this is universally grown in St. Kitts and elsewhere in the West Indies as a "green dressing" on sugar estates ; (3) *Phaseolus lunatus*, the sugar or Lima bean known in Mauritius as "Pois d'achéry" ; "it remains on the land for three years and produces large crops of fodder." The ripe beans are however regarded as poisonous ; (4) *Dolichos lablab*, the Madagascar or Lablab bean, this is known in Mauritius as the "Antaque" ; (5) *Dolichos purpureus*, propably a variety of the latter known in Queensland as the Poor Man's bean ; (6) *Phaseolus Mungo*, the green gram of India, known in Barbados as "Woolly Pyroe." This is planted "after the canes are reaped and afterwards turned in as a green dressing."

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 141.] SEPTEMBER. [1898.

DCXXII.—CHINA GRASS. 1891 ONWARDS.

In former articles* in the *Kew Bulletin*, the names China grass, Ramie, and Rhea, have been applied, as had been customary, indiscriminately to the products of *Bœhmeria nivea* and *B. tenacissima*. It is now generally agreed to employ them with more precision.

CHINA GRASS is obtained from *Bœhmeria nivea*, easily recognised by the white under side of the leaves, which yields an annual crop of stems in the open air, even in England.

RAMIE or RHEA is obtained from *B. tenacissima*, which has the mature leaves green underneath, and in this country can only be grown under glass.

PARIS TRIALS.

Trials of machines for the preparation of China grass were held at Paris in the years 1888, 1889, and 1891.

The first were under the direction of the French Government; the results were given in the *Kew Bulletin* for 1888 (pp. 273–280). The second were in connection with the Paris Universal Exhibition of 1889; the results were also published in the *Kew Bulletin* (1889, pp. 268–278; 284–287). The third was not a Government

* The previous articles that have appeared in the *Kew Bulletin* on this subject are as follows:—

1. Previous history and an account of an industry started at Barcelona, Spain, 1888, pp. 145–149.
2. Report of the *Concours Internationale de la Ramie*, held at Paris, 1888, pp. 273–280.
3. Summary of the present position of China grass and Ramie, 1888, pp. 297–298.
4. Report of trials of Ramie machines at the *Exposition Universelle*, Paris, 1889, pp. 268–278.
5. List of awards for the decortication of Ramie, made at the *Exposition Universelle*, Paris, 1889, pp. 284–287.
6. Ramie leaves as a food for Silkworms, 1890, pp. 174–175. (This was afterwards shown to be not well founded; *see* "Insect Life," Vol. III., p. 501).
7. Note on a trial of methods and appliances for decorticating and preparing Ramie, held by the *Société des Agriculteurs de France*, 1891, pp. 277–278.
8. China grass at Glasnevin, 1892, p. 251.
9. Trials of Ramie machines at New Orleans, 1892, pp. 304–306.

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competition, but was held under the auspices of the Société des Agriculteurs de France. A brief notice is given in the *Kew Bulletin* (1891, pp. 277, 278). It was attended by the Director on behalf of the India Office.

The trials of 1891 took place at Gennevilliers, near Paris, on the Ramie plantation belonging to the Société Agricole de la Ramie. The plant cultivated was China grass (*Bœhmeria nivea*) and it was understood that its cultivation had the advantage of a supply of Paris sewage. The growth of the crop was extremely vigorous and in that respect left nothing to desire. The stems succumb to the first frost, which however does not appear to injure the roots.

Six machines were submitted for competition ; of these only the four which received rewards require notice.

Faure Machine.

This received a gold medal. It admitted of being worked by hand, but the most satisfactory results were obtained when driven by a steam motor. It exhibited great mechanical ingenuity in the details. The leafy stems of China grass as cut from the plantation were fed on to a table from which they were drawn in leaf-end foremost by two revolving rollers. Behind these was the decorticating apparatus. This consisted of a drum carrying twelve beaters which appeared to be made of simple T iron. The bed against which these beaters worked was a quarter of a cylinder, the radius of which was smaller than that of the drum carrying the beaters. The space between these and the surface of the bed therefore varied. The beaters first strike the stems and without injuring the fibrous cortex, break up the woody core into segments about an inch long. As the stem passes on into the wider space the beaters operate with a scraping action which dislodges the core-segments from the cortex. This, now converted into a ribbon, is again seized by the beaters as it leaves the bed, and when released is blown on to an endless cord which catches each ribbon in the middle and carries it to dry at any distance from the machine that may be desirable. The leaves, which it was thought would be available for fodder, and the fragments of the core are driven away by the centrifugal force of the drum. The Faure machine in this form produced clean ribbons without apparently bruising the fibre, but did not remove the epidermis. It had the advantage of working continuously, but did not always disengage the core from the butt-end of the stems. It required the attention of three men ; two to feed and one to remove the ribbons. The result of one trial was to obtain from 1 cwt. of fresh stems 4 lbs. (when dried) of ribbons in six minutes (or 400 lbs. of dry ribbons for a day of ten hours) ; these ribbons after degumming yielded 1½ lbs. of filasse, or 2·6 per cent.

The Faure machine of this type has however been apparently abandoned by its inventor. The form at present in use will be described subsequently.

De Landtsheer Machine.

This was not materially different in principle from that exhibited at previous competitions. It is described in the *Kew*

Bulletin for 1888 (pp. 275–276) and 1889 (pp. 271–272). It received a gold medal partly on the ground of the long services of the inventor to the solution of the problem.

Barbier Machine.

This also did not appreciably differ from that shown at previous trials. It has already been described in the *Kew Bulletin* (1888, p. 276; 1889, p. 269).

Subra Machine.

This resembled in some respects the two preceding machines. But the beaters work continuously without reverse action. There was an arrangement by which the workman in charge could elevate the upper feeding cylinder and so release the stems which were then reversed by hand. The jury was, however, of opinion that the Subra machine, except in the hands of exceptionally skilled workmen, would probably lead to serious accidents. It had, however, the advantage of removing the epidermis in great part as well as the woody core from the ribbons.

Like the Faure, the Subra machine in the form now described has also been abandoned.

Since 1891 the problem of treating the fresh stems of China grass by mechanical methods has engaged incessantly the attention of inventors. The results up to the present time are reviewed in the following pages. For convenience a general summary is given in the first place of the facts relating to the raw material.

SOURCE OF MATERIAL.

Perhaps the most important advance has been in the complete abandonment of the attempts hitherto made to treat the dry stems. This has been definitely acknowledged to have been a mistake, experience having proved that to obtain the full advantage of the many valuable qualities of the fibre the stems must be treated in the green state.

The original China grass so long cultivated by the Chinese under the name of *Tchou Ma* is *Bœhmeria nivea*, Hk. & Arn. The leaves in this are white-felted beneath. The plant is moderately hardy in temperate countries, and it grows well during the summer months in the South of England. During 1895 an exceptionally good crop was harvested at Kew from a small plot that had been established in the open ground for more than five years. An equally large crop is being produced this year (1898). The plants are, however, regularly cut down by the first frosts in October and do not sprout again until the middle or end of May. Thus only one crop is capable of being produced yearly. *Bœhmeria nivea* is the plant chiefly cultivated in the South of France, Algiers, the United States, and many parts of India. The plant is more readily propagated by division of the rhizome or rootstock than from seed.

Ramie or Rhea is probably only a geographical variety of China grass, but from an economic point of view the differences between them are so important that the two plants should be kept quite distinct. The Ramie or Rhea (*B. tenacissima*, Gaud.) is

sometimes known as the green-leaved China grass. This name has been given it as the leaves are green on both surfaces. On this account it can be readily distinguished from ordinary China grass in the field. In habit the plant is more robust and the stems under favourable conditions are larger and more numerous. Ramie or Rhea is a native of Assam, the Malay Peninsula and the neighbouring islands. Rhea is the Assam and Ramie the Malay name for one and the same plant. The Malay name is the one generally used in this country; in India, Rhea is chiefly used. This plant thrives only in tropical countries and it is useless to attempt to cultivate it elsewhere. At Kew it will only grow well when kept under glass all the year round.

Both plants require good deep soil such as is found in alluvial deposits in tropical countries. The climate should be warm and humid and without a prolonged dry season. In the systematic treatment which China grass receives at the hands of the Chinese it is abundantly supplied with moisture and manure, and by these means several crops are produced in one season. Hence poor soil and rather dry situations are quite unsuitable for growing these plants. The relative yield of China grass and Ramie over large areas has not yet been definitely determined. This is a matter that deserves careful investigation, as also the relative quality of the fibres and their suitability for various textile purposes. The two plants are kept distinct in Jamaica. Mr. W. Fawcett, F.L.S., Director of the Botanical Department in Jamaica states:—"The green-leaved Ramie (*Bœhmeria tenacissima*) is evidently the best for low elevations, while China grass with the white under-surface (*Bœhmeria nivea*) is the best for the hills. At Cinchona (4,800 feet, with a mean temperature of 61·4° F.) the latter is growing 10 to 12 feet high." As regards difference in growth Mr. W. Cradwick, at the Hope Gardens (elevation 600 feet, mean temp. 75·4° F.), finds that the "green variety produces with similar treatment about double the number of canes per root."

In the *Agricultural Ledger* (1894, No. 6, p. 4), issued by the Government of India, Dr. Watt draws attention to the different requirements as regards climate between China grass and Ramie in the following words:—

"It would obviously be a mistake to attempt the cultivation of the temperate-loving plant (*B. nivea*) in the tropical plains of India. But so far as can be ascertained this is actually what has been done in the majority of experiments hitherto conducted in India. From time to time fresh supplies have been imported from China and distributed all over this country, so that India may fairly be characterised as having fully attempted the acclimatisation of China grass, but done little or nothing towards endeavouring to extend the production of Ramie (*B. tenacissima*) which, for the sake of convenience of expression, we may characterise as its indigenous stock."

As regards other points of difference between China grass and Ramie the following opinion was expressed in a letter addressed by Kew to the India Office, dated the 8th May, 1890:—

"Whether the fibre of Ramie is at its best really as good as the best China grass (*Bœhmeria nivea*) is a point that appears not to

have been definitely settled. It may turn out to be simply a question of soil and climate. China grass may give a larger and better supply of fibre under cool conditions, whereas Ramie or Rhea may do equally well under essentially tropical conditions. The question as regards India may easily be settled by cultivating under various condition of climate and soil authentic specimens of each plant, and by instituting, as suggested by Dr. Watt, a careful chemical and microscopic analysis of the fibres yielded by Indian-grown plants of both *Bœhmeria nivea* and *B. tenacissima*."

In the United States, with a comparatively temperate climate, except in the extreme south, the plant so far cultivated is China grass (*Bœhmeria nivea*). In a "Report (No. 7) on the Cultivation of Ramie in the United States," by Mr. Chas. Richards Dodge, issued by the U. S. Department of Agriculture (Washington, 1895), the distinctions between China grass and Ramie are not so clearly kept in view as could be wished. Practically the former only is dealt with. But the name Ramie or Rhea is unfortunately applied to it. It is probable that China grass (*Bœhmeria nivea*) is the more common plant under cultivation at the present time, but it is possible also that, where Ramie or Rhea (*Bœhmeria tenacissima*) is grown, sufficient emphasis is not laid on the fact that it is not the ordinary China grass of commerce. As pointed out by M. Charles Roux in *Notice sur la Ramie*, "this error has crept into many publications and has been extremely prejudicial to the development of this culture. It has been represented that Ramie (*Bœhmeria tenacissima*) is successfully grown in France, but well organised experiments have proved that this is a mistake. Ramie is essentially a plant of warm countries." The plant chiefly cultivated in France, and possibly in Algiers also, is China grass (*Bœhmeria nivea*). The fibre at present known in commerce as China grass is the produce of *B. nivea*, prepared entirely by hand labour in China. The stems are first stripped and the epidermis removed by scraping and washing, but a good deal of the gum is still left in contact with the fibre. This has subsequently to be removed by chemical means in Europe. The quantity of this China grass fibre available is somewhat limited. It forms, however, the chief source of the raw material used for China grass fabrics hitherto produced in this country and the Continent.

Ramie in commerce is a term applied indifferently to the produce of either *B. nivea* or *B. tenacissima*. Its chief use in Trade Reports appears to be to distinguish between machine-prepared fibre ("Ramie") and the hand-cleaned fibre of the Chinese ('China grass'). The machine-cleaned fibre in commerce consists of (1) ribbons or strips which are merely the cortical layer removed from the stems and dried; or (2) the grey, brown, or whitish fibre in a more or less cleaned condition, freed from wood, and from the epidermis and gummy matters.

The use of the term China grass applied to the hand-cleaned fibre shipped from China is free from objection. It is really the produce of *B. nivea*, and no confusion is likely to arise. The term should, however, be applied to all fibres, whether cleaned by hand or by machine, if originally derived from *B. nivea*. The latter might be called "machine-cleaned China grass." On the other hand the term Ramie should be strictly limited to the produce of

B. tenacissima. A classification of the hand- and machine-cleaned fibres appearing in commerce (showing also their origin) might be adopted as follows :—

1. Commercial China grass (hand-cleaned in China). 2. China grass ribbons or *lanières* (hand- or machine-cleaned). 3. China grass raw fibre (machine-cleaned).	Produced from the China grass plant, *Bœhmeria nivea.*

1. Ramie or Rhea ribbons or *lanières* (hand- or machine-cleaned) 2. Ramie or Rhea raw fibre. (machine-cleaned).	Produced from the Ramie or Rhea plant, *Bœhmeria tenacissima.*

The completely cleaned and bleached fibre or *filasse* could be easily distinguished as China grass filasse or Ramie or Rhea filasse, according to the plant from which it was originally obtained.

During the last five years more interest appears to have been taken in these fibres in the new world than in the old.

The United States Department of Agriculture has organised a systematic series of experiments in different sections of the country, and these are likely to produce very interesting results. Mr. Richards Dodge's Report (No. 7) already mentioned contains a large mass of very useful information. In fact, it may be regarded as containing, from the American point of view, all that is known practically of the cultivation and treatment of China grass.

Planting.

The following is extracted from the *Foreign Office Report, Annual Series*, 1897, No. 2017, p. 8. :—

"The cultivation of the Ramie plant [probably China grass], the fibre of which is superior to flax, on the lands owned by the Imperial domains at Chakva, near Batoum, is attracting a good deal of attention just at present. The climate and soil of the low-lying land in that locality appears to suit this plant extremely well, and within two years it has developed to so great an extent that the Administration of the Imperial domain lands is able to furnish a considerable quantity of the dried stalks to the Government Paper Mills at St. Petersburg, where it is to be used in the manufacture of the paper from which rouble notes and stamped bill of exchange forms are made."

As already stated, both China grass and Ramie have been grown experimentally in Jamaica, and a very useful Memorandum has been published by Mr. W. Fawcett, F.L.S., in the *Bulletin of the Botanical Department* (1894, pp. 33–34). This contains, also, a Report of the Jamaica Committee with reference to a prospective trial of the Allison Fibre Machine. The following extracts give the cultural results obtained in Jamaica (*Report of the Director*, 1894–95, pp. 221–224) :—

"From experience I think there is little reason to doubt that the best part of the plant to propagate from is the bottom of the

ripe stem. If a field is being reaped, and it is desired to increase the area, then the canes should be reaped, cutting them to within two inches of the ground. Some one should then follow and grub out the remainder of the stalk, going low enough, if possible, to secure a little root on it. This will generally give a piece about four inches long, and if inserted into the ground with about half an inch left above the surface will make a strong plant in an incredibly short space of time. The old plants will be all the better for the removal of the stems for propagating. In the event of not wishing to propagate, care should be taken to cut the stems as low as possible, as the plants grow much stronger than when the old stumps are left five or six inches above ground.

"The best distance to plant is twelve inches apart, with eighteen inches between the rows on fair land, but on strong land eighteen inches to two feet would be quite close enough. If planted nine inches apart they have to be hand-weeded when young, which is very expensive, whereas at eighteen inches or two feet they can be hoed through. If the land is fairly rich and they are kept clean while they are young, they will grow so thickly, even at two feet, that very little weeding is required, except, perhaps, after cutting. The piece which was planted three feet apart is now so thick as almost to prevent any weeds growing, except when the crop is reaped."

For a long period Rhea has been grown in small quantities by the natives of Assam. A note on its cultivation was issued by the Agricultural Department, Assam, in April, 1897. This was prepared by Mr. F. J. Monahan, Officiating Director of Lands Records and Agriculture. He states that the Rhea of Assam at the present day is *Bœhmeria nivea*.

A useful memorandum on the cultivation of *Bœhmeria nivea* in Mysore was issued in 1897 by Mr. J. Cameron, F.L.S., Superintendent of the Lal Bagh Gardens at Bangalore. This contains an excellent, almost life-size illustration of the plant in flower and fruit.

A note on the same subject was published by Mr. Ridley in the *Agricultural Bulletin of the Malay Peninsula* for June, 1897.

A very interesting correspondence relating to the introduction of Ramie cultivation into Perak appeared in *Perak Museum Notes* (Vol. ii. pt. 2, pp. 103–124.)

Yield of Stems and Fibre.

More accurate observation has shewn the probable yield that may be obtained both in stems and fibre from a given area.

From a small patch of China grass (*Bœhmeria nivea*), five years old, growing in the open air at Kew, it has been found that four square yards yield 100 stems. The weight of these, without leaves, was 24 lbs. This gives a yield at the rate of 29,000 lbs. (say 13 tons) per acre. In Algiers, Hardy found that an acre yielded 27,000 lbs. of similar stems without leaves. De Mas, at Padua, found that Ramie (*Bœhmeria tenacissima*) yielded in the second year stems, without leaves, at the rate of 26,300 lbs. per acre; in the third year two crops yielded at

the rate of 32,360 lbs. per acre. The weight of raw fibre (ribbons ?) per acre obtained by De Mas from 32,000 lbs. of green stalks, without leaves, was 1,280 lbs. or exactly 4 per cent. Favier gives somewhat similar results. His actual yield was 1,285 lbs. per acre. In California, Hilyard gives it at 1,935 lbs. per acre. It is probable that the yield of clean ribbons per acre on a large area, with two or three cuttings, will average about 900 to 1,000 lbs. per acre. Mr. Charles Richards Dodge, of the United States Department of Agriculture, is of opinion "that two cuttings of second year's growth, when properly cultivated, will produce 20 tons of green stalks with their leaves." Further, "as each ton of green stalks, with leaves, will yield 46½ lbs. of clean, dry ribbons or raw fibre, giving 25 lbs. of degummed fibre," we have, therefore, a return per acre from two cuttings equal to 930 lbs. of clean ribbons and 500 lbs. of degummed fibre or filasse. No returns of the actual fibre have, however, been made continuously on a sufficiently large scale to justify absolute confidence in them. At Wenchow, China, it has been found that an acre, in one cutting, yields 80,000 stems, giving 312½ lbs. of fibre. This would probably be the ordinary ungummed China grass as received in this country. Three crops would, therefore yield at the rate of 937½ lbs. per acre.

Machines.

In this country many machines and appliances have been brought into notice, but owing to the absence of a suitable supply of green stems no exhaustive trials have been held. Such trials are only possible when a large area specially cultivated for the purpose is available. As already shown, the conditions in this country, except in specially mild situations, are not favourable for the cultivation of China grass. The stems grown at Kew have, however, been placed at the disposal of persons making application for them.

An experiment with these stems (*Bœhmeria nivea*) was made with a Subra machine in October, 1895. It must be understood that the results here given represent a single trial only, and no opinion is intended to be expressed as to the capabilities of the machine working continuously on a large scale. The stems were divided into two series as follows :—

Series A.—Green stems : selected.

Series.	Condition.	No. of Stems.	Weight in grammes.	Weight of Wet Ribbons delivered by machine.	Wet Ribbons after shaking by hand.
I.	Stems with leaves attached.	27	1,361	454	318
II.	Stems without leaves.	29	1,134	567	319

Series B.—Green stems: rather woody.

Series.	Condition.	No. of Stems.	Weight in grammes.	Weight of Wet Ribbons delivered by machine.	Wet Ribbons after shaking by hand.
III.	Stems with leaves.	21	2,722	907	459
IV.	Stems without leaves.	22	2,268	1,021	599

The Subra machine (in its present form) weighs about 3 to 4 cwts., and has the appearance of an ordinary chaff cutter. The stems, 12 to 20 in number, are fed at one end, and pass quickly through a series of crushers and rollers, and are delivered on a revolving apron, from which they are taken by hand and well shaken. The latter treatment gets rid of most of the adhering wood. The ribbons are then ready to be hung up to dry. The machine requires one-half horse power, but was worked during the trial entirely by hand. The stems can be treated either with or without the leaves. There is no reverse action as in most machines, and hence the whole of the stems pass rapidly through, and are at once delivered on the apron ready for shaking and drying. It is impossible to speak conclusively of a single trial, and with such a very limited number of stems. The following reports on the trial, furnished to the Subra Company by Messrs. Cross & Bevan, give, however, the results actually attained:—

No. 1.

MESSRS. CROSS AND BEVAN TO THE SUBRA COMPANY, LTD.

Laboratory, 4, New Court, Lincoln's Inn, W.C.,
16th October, 1895.

DEAR SIRS,

HAVING been present at your request at a trial of the working of your Decorticating Machine (Subra, Eng. Pat. 23,642/94) we now beg to report as follows:—

China Grass Stems (*green*).—The stems were supplied from Kew. The results obtained on the machine were quite satisfactory. The ribbons prove on examination to be intact, and are therefore stripped without injury to the filasse. The wood was quite free from fibre, and on the other hand the ribbons retained only a fractional percentage of wood. We, of course, had no opportunity of making a continuous run with a large weight of stems, and can therefore only form an estimate of the behaviour and output of the machine under ordinary conditions of work. Our estimate is favourable. We were not able to see any weak point in construction or operation calculated to interfere with continuous working and steady efficiency.

Yours faithfully,
(Signed) CROSS & BEVAN.

Messrs. The Subra Fibre Co., Ltd.

No. 2.

Messrs. Cross and Bevan to the Subra Company, Ltd.

Laboratory, 4, New Court, Lincoln's Inn, W.C.,
October 21, 1895.

Dear Sirs,

We beg to hand you the further results of our examination of the samples of China grass ribbons referred to in your favour of the 9th instant. Each sample was received sealed.

The following are the results :—

—	1	2	3	4
Weight as received by us, in grammes ...	318	319	459	599
Weight when air-dried	72	68	129	148
Weight of adhering wood	4·5	2·0	2·0	3·8
Percentage of adhering wood	1·4	·6	·43	·6
Weight of filasse	—	—	76	—
Percentage of filasse on green ribbon ...	—	—	16·5	—
Percentage of filasse on dry ribbon ..	—	—	58	—
Percentage of cellulose in filasse	—	—	8·0	—

Yours faithfully,
(Signed) Cross & Bevan.

Messrs. The Subra Fibre Co., Ltd.

The result of the investigation in regard to Sample 3—mature stems with leaves—may be summarized as follows :—The green stems with leaves weighed 2,722 grams., and yielded air-dry ribbons weighing 129 grams. This is at the rate of 4·7 per cent. The same dry ribbons yielded filasse weighing 76 grams. This is at the rate of 58 per cent. on the dry ribbons, and at the rate of 16·5 per cent. on the wet ribbons. On the other hand the percentage of filasse obtained from the green stalks with leaves is 2·8 per cent. According to this, 100 tons of green stems with leaves (of *B. nivea*) will yield 4·7 tons of air-dried ribbons, and 2·8 tons of pure fine filasse.

While the yield of air-dried ribbons closely agrees with the Paris trials, the yield of filasse is nearly double.

The following report was made by Messrs. Ide and Christie on a sample of China grass ribbons prepared by the Subra machine from green stems grown at Kew :—

Messrs. Ide & Christie to Royal Gardens, Kew.

72, Mark Lane, E.C.,
2nd October, 1895.

Sir,

Your favour of the 29th instant, with the sampie of China grass ribbons, is duly to hand. The latter appear to be fairly well done, but we notice many bits of the wood still adhering to them. This should not be, as it is a fatal objection with many.

We value them at £10 to £12 per ton, but would require a few tons for distribution before being able to say definitely whether in this state they would be preferable or otherwise to the ordinary cleaned China grass.

Yours faithfully,

(Signed) IDE & CHRISTIE.

D. Morris, Esq., C.M.G., D.Sc.

Faure's Decorticator.

The Faure machine, as already stated, has taken a new form since the Paris trials of 1891. The improved machine was under trial at Limoges in July of 1897. In the construction, the inventor has aimed at the production, in one operation, not of ribbons or strips, but of fibre "free from woody matter, from skin, and with the least amount of 'juice' in it." He claims that the product is equivalent to commercial "China grass," but in a more uniform condition, and free from the possibility of adulteration. The new Faure machine "is fed by two men, working alternately, each holding in his hand about ten stems. The stems are treated green in the same condition as cut, with the leaves attached. The operation of feeding is as follows:—The stems are passed twice. They enter the machine leaf end first, and after being treated about two-thirds of their length they are withdrawn, an operation easily carried out, and fed in a second time, the thick end first, so as to complete the operation . . . The machine is simple in construction. Practical experience shows that two men working at one machine can treat 360 pounds of fresh green stems per hour, or about 35 cwts. per day of ten hours. The amount of dry fibre produced depends on the nature and growth of the stems . . . On a 5 per cent. basis, the net production of dry fibre by each machine per day is 180 pounds. . . . Under ordinary circumstances, a production varying from 160 to 200 pounds of dry fibre in ten hours per machine may be expected."

This is the inventor's own account of the capabilities of the machine. The first point that will occur to those acquainted with the numerous efforts to extract the fibre by mechanical means is the necessity that still exists, even in this improved machine, to pass the stems twice into it. About two-thirds of the stem are first cleaned and withdrawn, they are then reversed, and fed in a second time to complete the operation. This practically reduces the capabilities of the machine almost by one-half.

Experience in the cleaning of Agave leaves (a problem now happily solved) has shown that the only effective way is for the raw material to be presented once only to the machine and it should pass through without further handling. When this is the case a boy of fifteen can do the work of two men, and feed a machine yielding half a ton of dry fibre per day.

It is to be noted that the prepared fibre from the Faure machine is claimed to be "equivalent to commercial China grass." The latter is hand-cleaned fibre with an average value in the London market of about £30 per ton. With a possible maximum yield of 2 cwts. of dry fibre per day from the Faure machine the gross

value would be £3. This would be the approximate value of fibre "produced on a 5 per cent. basis from a ton of green stalks with leaves."

The most complete and recent account of the Faure machine is given in the report of a lecture delivered before the Indian Section of the Society of Arts by Mr. Thomas Barraclough on the 25th March, 1897. This is published in the *Journal Soc. Arts.* (vol. xlv., April 2, 1897, pp. 424–440); see also *British Trade Journal* (May 1, 1898).

"The machine, which weighs 11 cwt., is very strong and not liable to get out of order. It consists mainly of the framework and driving-gear, the decorticating drum carrying beaters and the feed-bed. This latter is the important feature of the machine, by reason of its special contour which varies at different parts to suit the various descriptions of work which the machine has to perform. The first part of the bed is curved outwards, the second is straight, and the third is curved inwards. The stems are fed into the machine over the first part of the bed, where the woody portion becomes immediately broken and partly removed; the strip passes on to the second part, and as the speed of the beaters is considerably greater than that at which the stems are fed into the machine, a scraping effect is produced on the strips, seeing that the distance between the beaters and the surface of the bed is less than the thickness of the strip. This scraping action effects a double purpose; it attacks the outer skin and also all matters extraneous to the fibre. The strips then pass down vertically into the machine, and the separated matters, viz., most of the woody parts, the skin, and gummy substances, are thrown out to a distance by the centrifugal force of the beater drum. When the stems have entered to within a short distance of their end, the return movement is effected and they are withdrawn. During the withdrawal the following action takes place: At the inward curve or third part of the bed, the filaments are slightly and gradually grazed by the beater blades, which throw out the coarser of the *débris* still adhering. The operation is performed with great delicacy; the fibres assume the position of the chord of the curve, and are constantly agitated by the beaters. When the fibres arrive at the second part of the bed, as the space between it and the beaters is infinitely reduced, the entire removal of matters still adhering to the fibres is effected, and these latter leave the machine white, parallel, and free from woody matter, from skin, and from the major portion of the juice. The concave bed or breast is mounted in such a way that its position to the action of the beaters is easily regulated. The brackets which carry the bed are supported by spiral spring cushions and flexible legs, the object being to obtain a rubbing action between the beaters and the fibre, having for its special object the loosening and removal of the skin. The elastic bed gives way or vibrates an enormous number of times per minute, and this produces the desired rubbing or 'knuckle-joint' action between the beaters and the fibres on the bed. The shape of the feed-bed causes it to remain clean and free from extraneous matter through the action of the beaters. Choking is thus rendered impossible. All abnormal strains are avoided, and the machine can be kept at work from morning till night without stoppages for cleaning.

The refuse falls underneath the machine, and is removed from time to time. In the case of a number of machines working together, an endless band or conveyer, passing under the machines, removes the refuse continually, and so keeps the neighbourhood of the machines perfectly free from it."

McDonald-Boyle Decorticator.

This machine, also constructed on the plan of a revolving drum and beaters with a reversing process, has been carefully tried in Trinidad and Jamaica, and appears to be under trial at the present time in the Malay Peninsula.

The result of the operations in Trinidad are given in the *Proceedings of the Agricultural Society* (1897, pp. 149–153). The following is an extract :—

"The McDonald machine the committee saw at work simply produced 'Ramie ribbons' by breaking up and detaching the woody core of the stems, which it did far more expeditiously and cheaply than could be done by the cheapest hand labour and the operation is so easy that the machine cannot get clogged or out of order, and requires no skilled labour. The machine was under the disadvantage of being run by a steam engine not under proper control, but in ten minutes we saw it decorticate 18 lbs. of stem, giving 2½ lbs. of green fibre, which would equal 1 lb. of dry. Working under proper conditions, we are of opinion the machine with one trained man would be able to treat about one ton of stems in 12 hours, yielding one cwt. of ribbons, which is estimated to give 75 per cent., or 84 lbs. of 'filasse' or cleaned fibre, after undergoing the degumming process.

"The Boyle process degums the ribbons by treating them with certain simple and inexpensive chemicals, and we saw the process carried out on a small scale."

The results in Jamaica are published in the *Journal of the Jamaica Agricultural Society* (Vol. 1, 1897, pp. 271–272.) "The summary of five tests was as follows: Weight of green stems passed through the machine, 99 lbs. 14 ozs.; time occupied in treatment, 81 minutes; weight of wet ribbons produced, 18 lbs." The Committee added, "We think the whole process can only be operated successfully on a large scale by the central factory system."

In a Report issued by the Foreign Office (No. 2,139, Annual Series, 1898) on the trade of Guatemala, Mr. Consul Trayner states that experimental trials have been conducted by a wealthy inhabitant of that country who claims that, with a machine prepared locally, "the Ramie can not only be decorticated, but also degummed without damaging the fibre." It is impossible to offer an opinion on the merits of this machine with our present information, but, if it realizes the expectations of the inventor, we shall doubtless hear more about it.

Degumming.

No machine can do more than decorticate the stems of China grass, and more or less clean the fibre. There is still the further task of converting this into filasse fit for manufacture. One

intricate element in the problem is the dovetailing of the two processes, one mechanical, the other chemical. It was at first supposed that the degumming processes could effectually deal with ribbons, from which they would remove everything except the filasse. But there is some risk of injuring this by the prolonged action of chemicals, the treatment with which it is desirable to reduce to a minimum. Hence mere conversion into ribbons was thought to be no longer sufficient; the epidermis must be got rid of, and the fibre as far as possible mechanically separated. But at present the tendency appears to be to fall back on ribbons, and this implies the existence of methods which will produce filasse uninjured by the chemical treatment. Great hopes have been entertained of the Favier process, which still seems to hold the field in great measure. The United States Consul at S. Etienne in a report quoted in the *Journal of the Society of Arts* (Nov. 16, 1894, p. 946), describes this as "a chemical process of which M. Favier keeps the secret, but which is supposed to consist of a weak alkaline solution in which the fibres are boiled." Mr. Barraclough, in the lecture already quoted, says (p. 431): "Manufacturers use a variety of processes and apparatus. As a rule, the most successful of them keep their processes of degumming and bleaching to themselves, and do not patent them."

Boyle Process.

The following information respecting this process is taken from the *Glasgow Herald* (Aug. 13, 1895):—

"The Midland Spinning Company of Long Eaton claims that for the past twelve months it has 'been engaged in treating and degumming Ramie, and spinning the result into yarns which are being sold in the open market at very remunerative prices.' The process is the invention of Mr. H. H. Boyle, and is patented. The China grass or ramie arrives at the works in the form of ribbons or *lanières*. It is passed through a series of tanks, or chemical baths, which remove the gum and subsequently soften and bleach the fibre. The Ramie is drawn slowly through these, clasped between two endless chains kept moving by suitable gearing. At the feeding end the chains are kept about one foot apart one above the other, but as they near the first tank they approach until they firmly grasp the bundles of ramie placed between them. As the fibre passes from one tank to another the chains again separate and allow the Ramie to pass between rollers, which are fluted breaking cylinders in the first stage and wringing rollers in the latter part of the process. The gum is dissolved in the first tank, and when the Ramie has passed the rollers the fibre is sufficiently loosened to be pulled out free from the woody part of the bark. When the Ramie finally emerges at the end of the apparatus it is a pure white filasse, and after drying in a heated room is made into 'sliver.' The time occupied is a little over five hours. The sliver is gradually reduced to yarn by the usual roving and spinning frames, which are exactly similar to those for spinning silk and long-staple wools. Thus there can be no difficulty in working this Ramie-sliver in other spinning mills with their ordinary machinery. Twines, fishing-lines, and sail-cloth are also manufactured."

Gomess' Process.

A chemical process, the invention of Mr. A. F. B. Gomess, for the treatment of China grass or Ramie ribbons has been much discussed during the last three years. It is not intended to deal with hand-cleaned commercial China grass, but with "Black Rhea," by which is probably meant the stiff brown ribbons obtained by drying the bark when removed from the stems without any preparation beyond getting rid of the moisture in it. The ribbons may be stripped either by hand or by machine. From these dry hard ribbons it is claimed that by chemical means all woody particles, the epidermis and gum are removed, and that the fibre is delivered in the form of filasse ready for being combed and spun into yarn. This is practically all the information so far obtainable in this country. It appears, however, that an effort is being made to grow the China grass plant (*Bœhmeria nivea*), and the Ramie or Rhea plant (*B. tenacissima*) in India in order to supply the raw article in a suitable condition to be treated by this process. The following particulars are taken from the *Madras Weekly Mail* (July 1, 1896) :—

"The owners of the Gomess process, who are represented in England by the Rhea Fibre Treatment Company, Limited, 17, Shaftesbury Avenue, London, W., and in this country by the Indian Rhea Fibre Parent Company, Limited, Bombay, are prepared to contract for the purchase of large quantities of dried ribbons of bark, and in regard to this the London Company report :—

"(a.) That they require the raw material in the shape of ribbons; that is, the whole bark hand-stripped from the stem, thoroughly dried, and packed in bales.

"(b.) That they prefer the species *Bœhmeria nivea*, but that they can also use the *Bœhmeria tenacissima* and Ban-rhea (*Villebrunea integrifolia*).

"(c.) That the quantities required by the London Company would be continuous and very large; that it would be difficult to give exact figures, but that they could do with 10,000 tons to commence with.

"(d.) That they are at present prepared to contract at prices equivalent to from £10 to £11 per ton, delivered in London, or at £7 a ton at port of shipment in India."

Further particulars may be obtained from a publication entitled "Rhea, its Cultivation, Decortication, and Baling, and the subsequent treatment of the Ribbons by the Gomess Process," issued by the Rhea Fibre Treatment Company, 17, Shaftesbury Avenue, W.

Summary.

Few practical problems have consumed so much time and energy as the attempt to bring China grass and Ramie into use for manufacturing purposes. Notwithstanding all the expenditure of mechanical skill and inventive ability, the conclusion cannot be evaded that we are still as far off as ever from being able to place upon the market a finished product which will effectually compete with silk, flax, and the better qualities of cotton.

The plants can be grown with the greatest ease. But when the problem of treatment is solved, the supply of the raw material will be limited to warm countries. The cultivation of China grass in temperate regions will never be able to compete successfully with that of Ramie (or perhaps of China grass) in the tropics. It is known that when ribbons can be produced sufficiently cheaply, these can be degummed and turned into filasse at a small cost. The whole question then still turns, as in 1888, on the production of ribbons. We are still waiting for a decorticator which will not merely turn out ribbons fit for further manufacturing processes—that has been accomplished—but will turn out, say, half a ton a day at a small cost. Till this has been found, the planter cannot profitably deal with his crop, and the degumming processes now almost entirely dependent on hand-cleaned fibre from China are paralysed for want of a supply which will allow the finished product to compete with other fibres.

The ribbons must be susceptible of being delivered to the degumming factories at a cost not exceeding £7 to £9 per ton. This would pay the planter if he had a decorticator which would enable him to prepare the ribbons at a cost which would leave a profit. At present he cannot produce ribbons under £12 to £15 a ton.

Then the degumming processes should turn out filasse at a total cost of £36 to £40 per ton. At this price the demand would be considerable, and a large and prosperous industry would result. To put the position in other words, filasse must be put upon the market at about 4*d*. a lb. To use the words of one of the speakers in the discussion at the Society of Arts, "unless it could be brought down to something like the price of cotton or flax, it was impossible to make any profit out of it."

DCXXIII.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECADES XXXI.—XXXIII.

301. **Pellacalyx symphyodiscus**, *Stapf* [Rhizophoreæ]; disco breviter tubuloso sublobato atque staminum serie epipetala in lobulorum apicibus altera inter lobos ad basin disci inserta insignis.

Ramuli fulvo-hirtelli. *Folia* obovato-oblonga, abrupte obtuseque acuminata, basi rotundata, 3½–5 poll. longa, 2–2½ poll. lata, minute glanduloso-denticulata, supra pilis minutis fugacibus solitariis vel paucis fasciculatis e tuberculis albidis ortis conspersa, infra indumento simili laxo sed robustiore diutius persistente instructa, nervis admodum prorsus ductis utrinque circiter 6; petiolus crassiusculus, 4–6 lin. longus, hirtellus, demum glabratus; stipulæ ovatæ, obtusæ, dense fulvo-tomentellæ. *Flores* solitarii vel pauci, brevissime fasciculati, 5–6-meri; pedicelli fulvo-hirtelli, floribus æquilongi. *Calyx* campanulato-tubulosus, 4–4½ lin. longus fulvo-hirtellus; lobi triangulares, tubo triplo vel ultra breviores

Petala alba, obovato-oblonga, ob margines superne inflexos fimbrilligeros subcucullata, 1½ lin. longa, fulvo-pubescentia. *Discus* tubulosus, ¾–1 lin. longus, sublobatus. *Stamina* biseriata, insertione supra descripta ; filamenta minima.

BORNEO. Sarawak, Penkulu Ampat, *Haviland*, 2206.

302. **Jasminum nitidum,** *Skan* [Oleaceæ] ; ex affinitate *J. bifarii*, Wall, et *J. subtriplinervis*, Blume.

Ramuli graciles, subtiliter pubescentes. *Folia* simplicia, opposita, elliptico-lanceolata, apice breviter acuminata, basi subcuneata, nitida, supra viridia, glabra, subtus pallidiora, parce pilosa solum ad costam, venis primariis 3, 2–3 poll. longa, ¾–1¼ poll. lata ; petiolus 2½ lin. longus, dense pilosus. *Cymæ* paucifloræ, ramulos breves terminantes. *Flores* fragrantissimi ; pedicelli 4–5 lin. longi. *Calyx* pilosus, tubo quam dentibus breviore, dentibus linearibus recurvis 2 lin. longis. *Corolla* alba, tubo angusto ¾ poll. longo, lobis 9–11 lineari-lanceolatis quam tubo paulo brevioribus.

ADMIRALTY ISLANDS. Imported by Mr. W. Bull, of Chelsea.

303. **Macroscepis elliptica,** *N. E. Brown* [Asclepiadeæ] ; *M. urceolatæ*, Karst., affinis, corollæ tubo multo breviore differt.

Caules volubiles, longe hirsuti. *Folia* 6–7 poll. longa, 4–4¾ poll. lata, elliptica, cuspidato-acuminata, basi cordata, auriculis imbricatis, utrinque villosa, longe petiolata. *Umbellæ* breviter pedunculatæ, 8–10-floræ. *Bracteæ* 6–8 lin. longæ, ⅓ lin. latæ, lineares, acuminatæ. *Pedicelli* 3–4 lin. longi, hirsuti. *Sepala* 4–5 lin. longa, 2 lin. lata, oblongo-lanceolata, acuta. *Corollæ* tubus subglobosus, 2½ lin. longus ; limbus 1 poll. diam., planus, 5-lobus, extra minute pubescens, intra puberulus, olivaceus, fauce viridis. *Coronæ* lobi carnosi, deltoidei, truncati, dorso in corolla adnati, incurvi, albidi.

BRAZIL. Described from a living specimen, introduced by F. Sander & Co.

304. **Alpinia strobilifera,** *Baker* [Scitamineæ] ; a speciebus reliquis recedit spicis lateralibus prope basin caulis impositis.

Caulis foliiferus elongatus. *Folia* oblongo-lanceolata, facie glabra, dorso pubescentia, subpedalia, 2–3 poll. lata. *Flores* in spicis oblongis densis lateralibus prope basin caulis dispositi, ante anthesin in bracteolis membranaeceis inclusi. *Spicæ* 2 poll. longæ, 1 poll. diam. ; bracteæ ovatæ, persistentes, floribus breviores. *Calycis* tubus infundibularis, 2 lin. longus, lobis ovatis tubo æquilongis. *Labellum* obtusum, dorso villosum, 6 lin. longum.

BRITISH NORTH BORNEO. East Coast, *Creagh*.

305. **Zephyranthes (Zephyrites) longipes,** *Baker* [Amaryllideæ] ; a speciebus reliquis hujus sectionis recedit pedicello longissimo.

Bulbus ovoideus, 1 poll. diam., tunicis exterioribus membranaceis brunneis. *Folia* linearia, glabra. *Pedunculus* gracilis, fragilis, subpedalis. *Spatha* 15 lin. longa, deorsum cylindrica,

sursum bifida, valvis convolutis. *Pedicellus* 3–4 poll. longus. *Ovarium* oblongum, obliquum, 3 lin. longum. *Perianthium* pallide rubrum, 3 poll. longum, tubo brevi anguste infundibulari, limbi segmentis lanceolatis. *Stamina* perianthio triplo breviora, antheris lineari-oblongis. *Stylus* profunde trifidus. *Capsula* globosa, 6 lin. diam.

URUGUAY. Monte Video, on the banks of the river St. Lucia, flowering in December, *Cantera*, 2.

306. **Zephyranthes stenopetala,** *Baker* [Amaryllideæ]; a speciebus reliquis sectionis *Euzephyranthis* differt perianthii segmentis linearibus.

Bulbus globosus, 1 poll. diam., tunicis exterioribus membranaceis brunneis. *Folia* erecta, anguste linearia, glabra. *Pedunculus* gracilis, fragilis, uniflorus, 8–9 poll. longus. *Spatha* membranacea, 15 lin. longa, cylindrica, apice bifida, valvis parvis subulatis. *Pedicellus* erectus, 15–18 lin. longus. *Perianthium* pallide rubrum, 21 lin. longum, tubo brevi, limbi segmentis linearibus. *Stamina* perianthio triplo breviora, antheris parvis lineari-oblongis. *Stylus* tricuspidatus. *Capsula* oblonga, 2 lin. longa.

URUGUAY. Monte Video, on the banks of the river St. Lucia, flowering in January, *Cantera*, 10.

307. **Hippeastrum Arechavaletæ,** *Baker* [Amaryllideæ]; a speciebus omnibus *Euhippeastri* recedit limbi segmentis oblongis tubo anguste infundibulari æquilongis.

Bulbus globosus, magnus. *Folia* lorata, obtusa, glabra, 1½–2 poll. lata, ad basin e medio sensim attenuata. *Scapus* validus, 1½–2-pedalis. *Umbellæ* 4-floræ, spathæ valvis magnis oblongis, pedicellis 1½–2 poll. longis. *Perianthium* album, venis rubris decoratum, 3 poll. longum, limbi segmentis oblongis obtusis 8–9 lin. latis tubo anguste infundibulari æquilongis. *Stamina* limbo duplo breviora, antheris linearibus. *Stylus* profunde trifidus, antheris superans.

URUGUAY. Monte Video, *Cantera*, 1.

308. **Hesperaloe Davyi,** *Baker* [Liliaceæ-Aloineæ]; ab *H. yuccæfolia*, Engelm., recedit foliis latis medio subplanis, racemis copiose paniculatis, pedicellis brevibus medio articulatis, antheris magnis linearibus.

Herba acaulis. *Folia* dense rosulata, ensiformia, crassa, dura, viridia, 3–4 ped. longa, medio subplana, ad apicem acuminatum convolutum sensim attenuata, margine brunnea filis copiosis dejectis. *Pedunculus* (panicula inclusa) 12-pedalis; rami patuli, 1–2-pedales: pedicelli breves, erecti, fasciculati, medio articulati; bracteæ parvæ, ovatæ. *Perianthium* oblongum, viride, 8–9 lin. longum, segmentis oblongo-lanceolatis, facie albis venis crebris viridibus percursis. *Stamina* perianthio paulo breviora, antheris linearibus, filamentis applanatis. *Ovarium* ampullæforme, in stylum brevem erectum attenuatum.

CALIFORNIA? Received with a description from Mr. J. Burtt Davy, from the garden of the University of California at Berkeley.

309. **Nothoscordum uniflorum,** *Baker* [Liliaceæ–Allieæ]; a speciebus reliquis recedit pedunculo brevi unifloro.

Bulbus globosus, 6–8 lin. diam., tunicis exterioribus brunneis membranaceis, interioribus supra collum productis. *Folia* 6–8, synanthia, falcata, anguste linearia, glabra, 2–3 poll. longa. *Pedunculus* uniflorus, erectus vel curvatus, gracilis, 1–1½ poll. longus. *Spatha* membranacea, alba, 4 lin. longa, deorsum cylindrica, sursum bifida. *Pedicellus* 1–1½ lin. longus. *Perianthium* campanulatum, album, 3 lin. longum, segmentis oblongo-spathulatis obscure viridi-carinatis. *Stamina* perianthio distincte breviora, antheris parvis stramineis. *Stylus* ovario æquilongus.

URUGUAY. Monte Video, in Campos near the city, *Cantera*, 20.

310. **Fimbristylis Woodrowi,** *C. B. Clarke* [Cyperaceæ]; simillima et ex affinitate *F. geminatæ*, Kunth, Americæ incolæ, sed nuce trabeculata differt.

Herba glabra, tenuis. *Radix* fibrosa. *Culmi* cæspitosi, 1–2 poll. longi, apice 5-angulati. *Folia* tenuia, 1–2 poll. longa, ⅓ lin. lata. *Umbella* subcomposita, condensata, 6 lin. lata, 8–18-stachya; spiculæ sæpe geminatæ, 1½ lin. longæ, ½ lin. latæ, 20-floræ; bractea ima umbellam paulo superans. *Glumæ* undique imbricatæ, naviculares, brunneæ, carina viridi excurrente. *Stylus* 3-fidus. *Nux* obovoidea, trigona, longitudinaliter striata, inter strias horizontaliter trabeculata, alba, tuberculis paucis interdum ornata.

INDIA. Bombay; Bhandalla, *Woodrow*.

311. **Miscanthus oligostachyus,** *Stapf* [Gramineæ-Andropogoneæ]; habitu speciminibus macris *M. nudipedis*, Griff., similis, sed glumis acuminatis diversus.

Culmi graciliores, ultra 2 ped. longi, glabri. *Foliorum* vaginæ teretes, prope os pilosæ, ad nodos sericeæ; ligulæ brevissime ciliolatæ; laminæ e basi subrotundata lineares, tenuiter acutatæ, 5–9 poll. longæ, ad 3½ lin. latæ, planæ, subtus pilosæ, supra glabræ, marginibus scabris. *Panicula* ad racemos 2–3 reducta; rhachis communis ad 1 poll. longa, compressa, præter nodos pilosos glabra; racemi ad 3½ poll. longi, breviter pedunculati, 8–10-nodi, laxiflori, substricti, articulis 3–4 lin. longis glabris; pedicelli longiores ad 2–3 lin. longi, sursum paulo dilatati. *Spiculæ* lanceolatæ, 3½–4 lin. longæ, pallidæ, pilos involucrantes albidos vel purpurascentes æquantes; gluma i. eximie acuminata, bidentata, in carinis sub apice ciliata, fere ubique villis spiculam excedentibus obtecta, 6-nervis, nervis præter carinales infra apicem evanidis; ii. similis, tenuius acuminata, 3-nervis; iii. oblongo-lanceolata, aristulata, 1-nervis, marginibus ciliatis; iv. lineari-oblonga, minute bidentula, 2½ lin. longa, superne ciliata, basi 3-nervis, arista scaberula 7–8 lin. longa; palea parva, oblonga, hyalina, superne ciliata. *Lodiculæ* glabræ. *Stamina* 3; antheræ 1⅓ lin. longæ.

JAPAN. Nikko Mts., *Maries*.

312. **Erianthus formosanus,** *Stapf* [Gramineæ-Andropogoneæ]; *Erianthe fastigiato*, Nees, similis, spiculis minoribus et gluma iv. ciliata et staminum numero (2) distinctus.

Culmi subrobusti, 3 ped. alti, multinodes, summa parte excepta glaberrimi. *Foliorum* vaginæ ore fimbriatæ, cæterum glaberrimæ; ligulæ brevissimæ, truncatæ, ciliolatæ; laminæ lineares, basi vix angustiores, ad 1 ped. longæ, circiter $1\frac{1}{2}$ lin. latæ, marginibus scabris exceptis leves. *Panicula* obovato-oblonga, e racemis 15–20 composita, ad 6 poll. longa; rhachis communis ad 3 poll. longa, secundum angulos ciliata, racemis infimis paulo brevior; racemi sessiles, erecto-patuli, ad 5 poll. longi, flexuosi, graciles, albo-vel subroseo-villosi, multiarticulati; articuli pedicellique filiformes, $1–1\frac{1}{4}$ lin. longi, pilis duplo longioribus ciliati. *Spiculæ sessiles* lanceolatæ, $1\frac{1}{2}–1\frac{3}{4}$ lin. longæ, spadiceæ quam villi involucrantes 4-plo longiores; gluma i. chartacea, subacuminata, minutissime bidentata, carinis superne ciliolatis, in dorso medio longe pilosa, inter carinas marginesque tenuiter 1-nervis; ii. chartacea, lanceolata, acuta, longiuscule ciliata, 3-nervis; iii. oblonga, obtusa, hyalina, ciliata; iv. quam ii. duplo brevior lanceolata, hyalina, superne ciliata, ex apice subintegro aristata, arista gracili pallida 3 lin. longa; palea minuta, subrotunda, apiculata, hyalina, evenia. *Lodiculæ* glabræ. *Stamina* 2; antheræ $\frac{3}{4}$ lin. longæ. *Spiculæ pedicellatæ* sessilibus paulo minores; gluma i. ubique longe denseque pilosa; ii. in dorso pilosa.

FORMOSA. Taiwan, Apes' Hill, *Playfair*, 314.

This and *E. fulvus*, Nees, collected by Dr. A. Henry, near Ichang, Patung district (No. 5115), are the only species known from Chinese or Japanese territory.

313. **Spodiopogon Beccarii,** *Stapf* [Gramineæ-Andropogoneæ]; inter *Spodiopogonem* et *Erianthum* intermedius, ob ramos graciles et glumam i. haud manifeste carinatam priori adnumerandus, et, si divisionem generis a Hackel propositam accipias, juxta S. (*Pleurachnen*) *dubium*, Hack., ponendus.

Culmi robusti, ad 4 lin. crassi, glaberrimi. *Foliorum* vaginæ glaberrimæ, quam internodia paulo breviores; ligulæ breves, rotundatæ, firmæ; laminæ e basi angusta lineari-lanceolatæ setaceo-acutatæ, ad 9 poll. longæ, ad 9 lin. latæ, firmæ, glaberrimæ. *Panicula* ad 8 poll. longa; rami solitarii, graciles, basi longe nudi, inferiores ad $1\frac{1}{2}$ poll. longi, ad nodos barbati; racemi breviter vel brevissime pedunculati, pauciarticulati, brunnescentes, gilbo-villosi; rhachis fragillima; articuli $1–1\frac{1}{4}$ lin. longi, ut pedicelli paululo breviores clavati, glabri vel sparse pilosuli atque apice breviter ciliati. *Spiculæ sessiles* lanceolatæ villis involucrantibus paululo breviores; gluma i. oblonga, obtusa, circiter 2 lin. longa, apice subhyalina, præter margines ciliolatos glaberrima, nervis 4–6 subæqualibus vel 2 lateralibus paululo longioribus et validioribus vix carinantibus nec medio nervo distincto; ii. lanceolato-oblonga, subacuta, 3-nervis, marginibus breviter ciliatis; iii. præcedenti similis sed latior et paulo brevior; iv. oblonga, $1\frac{1}{2}$ lin. longa, ad medium biloba, lobis denticulatis arista ad 5 lin. longa; palea lineari-oblonga,

ciliata, 1¼ lin. longa. *Lodiculæ* glabræ. *Antheræ* vix 1 lin. longæ. *Spiculæ pedicellatæ* sessilibus similes, sed nervi glumarum i., ii. et iii. crebriores.

SUMATRA. Highlands of Padang, *Beccari*, 398.

314. **Diplachne Gatacrei**, *Stapf* [Gramineæ-Festuceæ]; affinis *D. serotinæ*, Link, sed paniculæ ramis gracillimis spiculas tantum 3–2 distincte pedicellatas gerentibus vel spicula solitaria terminatis atque glumis florentibus 3-nervibus distincta.

Herba laxe cæspitosa, ad 2 ped. alta, innovationibus abbreviatis dense foliatis. *Culmi* graciles, multinodes. *Foliorum* culmorum vaginæ arctæ quam internodia paulo breviores vel longiores; ligulæ ad seriem ciliarum minutarum reductæ; laminæ patulæ, breviter lineari-lanceolatæ, acutæ, 6–10 lin. longæ, glaucæ, asperulæ. *Panicula* laxa, 2½ poll. longa; rami infimi ad 1¾ poll. longi, spiculas 3–2 gerentes; cæteri spicula solitaria terminati: pedicelli spiculas æquantes. *Spiculæ* ad 5 lin. longæ, 4–6-floræ; rhachilla minute hirtella; gluma i. lanceolata, acuta 1½–2 lin. longa, hyalina, 1-nervis; ii. similis, sed magis oblonga et obtusior; glumæ florentes ovato-oblongæ, obtusæ, obscure emarginatæ, 2½ lin. longæ, glabræ, pallide virides, apicem versus sæpius purpurascentes, 3-nerves, mucronatæ.

INDIA. Chitral, Warai, 4500 ft., *Chitral Relief Exped.*, 1895, 17626.

315. **Alsophila Henryi**, *Baker* [Filices-Polypodiaceæ]; ab *A. Oldhami*, Bedd. (*A. scottiana*, Baker) recedit segmentis ultimis duplo latioribus distincte dentatis, venis 9–10-jugis, soris majoribus medialibus.

Caudex 5–20-pedalis. *Lamina* ampla, tripinnatifida, modice firma, utrinque viridia, glabra: pinnæ oblongo-lanceolatæ, 2–2½-ped. longæ, 9–10 poll. latæ, rhachibus castaneis facie pilosis dorso nitidis; pinnulæ lanceolatæ, sessiles, inferiores 4½–5 poll. longæ, 12–14 lin. latæ, profunde pinnatifidæ; segmenta tertiaria lineari-oblonga, dentata, 2 lin. lata; venæ segmentorum 9–10-jugæ, perspicuæ, erecto-patentes, omnes pleræque simplices, inferiores interdum furcatæ. *Sori* superficiales, globosi, inter costam et marginem mediales.

CHINA. Yunnan; forests of Mengtze, alt. 4000 ft., *Henry*, 11451.

316. **Davallia (Humata) platylepis**, *Baker*; [Filices-Polypodiaceæ]; frondibus *D. canariensi*, Smith, similis, recedit indusio late orbiculari marginibus liberis.

Rhizoma gracile, late repens, epigæum, paleis lanceolatis membranaceis ascendentibus ferrugineis demum albidis dense vestitum. *Lamina* deltoidea, 9–10 poll. longa, coriacea, utrinque glabra, rhachibus anguste alatis; pinnæ infimæ reliquis multo majores, tripinnatifidæ; pinnæ et pinnulæ basi inferiori cuneatæ; segmenta ultima parva, inæqualiter oblonga, obtusa; venæ segmentorum furcatæ: petiolus nudus, pallide brunneus, 6–7 poll.

longus. *Sori* globosi ad dentes ultimas solitarii. *Indusium* orbiculare, chartaceum, persistens, glabrum, $\frac{1}{3}$ lin. diam., basi affixum, marginibus liberis.

CHINA. Yunnan ; Mengtze, on rocks, alt. 4800 feet, *Henry*, 10082.

317. **Adiantum myriosorum,** *Baker* [Filices-Polypodiaceæ] ; habitu omnino *A. pedato*, Linn., simile, recedit soris parvis globosis, indusio reniformi persistente.

Lamina pedata, 8–9 poll. longa et lata, chartacea, utrinque glabra, intense glauca, rhachibus gracilibus nudis nitidis atrocastaneis : segmenta primaria 10, erecta, lanceolata, pinnata, centralia 6–8 poll. longa, 10–12 lin. lata, exteriora sensim minora ; segmenta ultima crebra, subsessilia, triangularia, margine superiori crenato fertili, marginibus inferioribus et interioribus rectis sterilibus ; petiolus 6–7 poll. longus, atrocastaneus, nudus, nitidus. *Sori* ad segmenta inferiora 4–5, globosi. *Indusium* reniforme, firmum, glabrum, $\frac{1}{2}$–$\frac{3}{4}$ lin. diam.

CHINA. Yunnan ; southern mountains of Mengtze, alt. 6000 ft., *Henry*, 9266.

318. **Nephrodium (Lastrea) Creaghii,** *Baker* [Filices Polypodiaceæ] ; a *N. caripensi*, Hook, recedit venulis 7–8-jugis, indusio persistente.

Stipites elongati, nudi, straminei, 15 poll. longi. *Frondes* oblongolanceolatæ, bipinnatifidæ, modice firmæ, utrinque virides, facie glabræ, dorso obscure pubescentes, sesquipedales, medio 6 poll. latæ, pinnæ multijugæ, sessiles, lanceolatæ, profunde pinnatifidæ, infimæ haud reductæ, majores 3–4 poll. longæ, 9–10 lin. latæ, segmentis secundariis lineari-oblongis integris obtusis 1 lin. latis, venulis simplicibus erecto-patentibus 7–8-jugis. *Sori* parvi, mediales, indusio glabro persistente.

BRITISH NORTH BORNEO. *Creagh.*

319. **Nephrodium (Lastrea) diffractum,** *Baker* [Filices-Polypodiaceæ] ; cum *N. undulato*, Baker, ceylanensi, rhachidi primario valde flexuoso congruit ; differt pinnis magis compositis, rhachibus alteris rectis.

Paleæ basales magnæ, lanceolatæ, erectæ, firmulæ, brunneæ. *Lamina* deltoidea, decomposita, 15–18 poll. longa, modice firma, utrinque viridia glabra, rhachi primario gracili stramineo nudo valde flexuoso ; pinnæ infimæ reliquis majores, deltoideæ, deflexæ, distincte petiolatæ, latere inferiori productæ ; segmenta ultima ovata, obtusa, basi inferiori cuneata ; venæ laxæ, simplices, perspicuæ, venulis lateralibus ascendentibus ; petiolus nudus, gracilis, pedalis. *Sori* parvi, globosi, ad bases dentorum ultimorum approximati. *Indusium* parvum, viridulum, glabrum, persistens, reniforme.

CHINA. Yunnan ; Mengtze, south-east mountains, in woods' alt. 8000 ft., *Henry*, 9028.

320. **Polypodium (Goniopteris) stenolepis,** *Baker* [Filices-Polypodiaceæ]; ad *P. lineatum*, Colebr., magis accedit; recedit venulis sorisque 3–4-jugis laxe dispositis.

Lamina deltoidea, 16–18 poll. longa et lata, simpliciter pinnata, subcoriacea, utrinque viridia, glabra, rhachi gracili stramineo subnudo; pinnæ lanceolatæ, acuminatæ, denticulatæ, breviter petiolatæ, basi utrinque rotundatæ, inferiores 7–8 poll. longæ, deorsum 8–9 lin. latæ; venæ primariæ parallelæ, venulis simplicibus ascendentibus 3–4-jugis: petiolus pedalis, sursum stramineus, nudus, deorsum paleis magnis squarrosis lineari-subulatis atrobrunneis præditus. *Sori* parvi, globosi, superficiales, 3–4-jugi, laxe dispositi.

CHINA. Yunnan; mountains north of Mengtze, alt. 5500 ft., *Henry*, 9038.

321. **Polypodium (Goniophlebium) aspersum,** *Baker* [Filices-Polypodiaceæ]; ad *P. subauriculatum*, Blume, magis accedit; differt pinnis paucioribus brevioribus, areolis utrinque costam sæpissime uniseriatis, soris paucis sparsis.

Rhizoma repens, epigæum, flexuosum, 2 lin. diam., paleis lineari-subulatis brunneis dense vestitum. *Lamina* oblongo-lanceolata, simpliciter pinnata, 15–18 poll. longa, 5–6 poll. lata, membranacea, utrinque viridia, glabra, rhachi gracili nudo; pinnæ infra apicem 10–12-juga, lanceolatæ, acuminatæ, obscure inciso-crenatæ, inferiores liberæ sessiles 2½–3 poll, longæ 4 lin. latæ basi utrinque rotundatæ, superiores basi adnatæ; areolæ utrinque costam sæpissime uniseriatæ: venæ liberæ, perspicuæ, laxe dispositæ; petiolus gracilis, nudus, 4–5 poll. longus. *Sori* parvi, globosi, superficiales, inæqualiter sparsi.

CHINA. Yunnan; Mengtze, south-east mountains, alt., 6000 ft., *Henry*, 9054.

322. **Polypodium (Phymatodes) subintegrum,** *Baker* [Filices-Polypodiaceæ]; ad *P. soridentem*, Hook., magis accedit; differt frondibus angustioribus subintegris, soris majoribus oblongis superficialibus.

Rhizoma epigæum, late repens, paleis parvis lanceolatis nigrescentibus membranaceis dense vestitum. *Lamina* anguste linearis, rigide coriacea, 10–12 poll. longa, medio 2 lin. lata, ad basin et apicem sensim attenuata, facie viridis glabra, dorso paleis minutis peltatis brunneis conspersa, marginibus obscure repandulis leviter revolutis: venæ præter costam obscuræ immersæ: petiolus subnullus. *Sori* magni, marginales, oblongi, superficiales, bullati, 2 lin. longi.

CHINA. Yunnan; south of the Red River, alt. 6000 ft., *Henry*, 9194 ex parte.

323. **Polypodium (Pleuridium) oligolepis,** *Baker* [Filices-Polypodiaceæ]; ad *P. hemionitideum*, Wall., accedit; differt soris utrinque prope costam uniseriatis, inter venas primarias parallelas solitariis.

Rhizoma epigæum, repens, 2 lin. diam., paleis lanceolatis sordide brunneis vestitum. *Lamina* lanceolata, integra, 9–12 poll. longa, infra medium 18–21 lin. lata, ad apicem sensim attenuata, basi secus stipitem decurrens, modice firma, facie viridia glabra, dorso præsertim ad costam parce paleacea; venæ majores margini pæne parallelæ; venulæ intermediæ in areolas copiosas anastomosantes; petiolus subnudus, gracilis, 4–6 poll. longus. *Sori* globosi, superficiales, 1 lin. diam., utrinque prope costam uniseriati.

CHINA. Yunnan; Mi-le district, *Henry*, 9896.

324. **Polypodium (Phymatodes) palmatopedatum,** *Baker* [Filices-Polypodiaceæ]: a speciebus reliquis hujus subgeneris recedit frondibus palmatopedatis.

Rhizoma epigæum, longe repens, 2-lin. diam., paleis magnis lanceolatis cuspidatis membranaceis sordide brunneis erectis dense vestitum. *Lamina* quadrata, pedato-palmata, basi cuneata, 10–12 poll. longa et lata, membranacea, utrinque viridis, glabra, facie nuda, dorso paleis minutis brunneis conspersa, segmentis 10–12 erectis lanceolatis leviter imbricatis, centralibus 7–8 poll. longis 12·15 lin. latis, exterioribus multo minoribus; venæ in areolas parvas hexagonas anastomosantes, primariæ parallelæ nullæ. *Sori* superficiales, prope costam uniseriati; inferiores oblongi vel lineari-oblongi, superiores globosi.

CHINA. Yunnan; Mi-le district, *Henry*, 9289.

325. **Polypodium (Phymatodes) trisectum,** *Baker* [Filices-Polypodiaceæ]; ad *P. trifidum*, Don, accedit; differt rhizomate gracili frondibus membranaceis trisectis, lobis lateralibus parvis erecto-patentibus.

Rhizoma epigæum, repens, gracile, paleis parvis linearibus appressis sordide brunneis vestitum. *Lamina* deltoidea, trisecta, 10–12 poll. longa, membranacea, utrinque viridis, glabra, lobo terminali lanceolato integro deorsum 18–21 lin. lato ad apicem sensim attenuato, lobis lateralibus multo brevioribus erecto-patentibus; venæ primariæ parallelæ, erecto-patentes, margini pæne productæ; venulæ intermediæ in areolas copiosas hexagonas anastomosantes, venulis liberis inclusis; petiolus gracilis, nudus, 4–5 poll. longus. *Sori* globosi, superficiales, ad costam contigui, utrinque costam uniseriati, inter venas primarias solitarii.

CHINA. Yunnan; Mi-le district, in woods, *Henry*, 9891.

326. **Polypodium (Phymatodes) triglossum,** *Baker* [Filices-Polypodiaceæ]; ad *P. trifidum*, Don, accedit; differt frondibus chartaceis trisectis, lobis lateralibus magnis erecto-patentibus.

Rhizoma repens, epigæum, paleis parvis lanceolatis membranaceis ferrugineis dense vestitum. *Lamina* deltoidea, trisecta, pedalis, chartacea, utrinque viridis glabra, facie nuda, dorso pallidiora, paleis paucis appressis membranaceis atro-brunneis peltatis vel ovato-cuspidatis conspersa; venæ primariæ parallelæ erecto-patentes, margini pæne productæ; venulæ intermediæ in areolas parvas hexagonas anastomosantes, venulis liberis inclusis

sæpe productis; petiolus subnudus, gracilis, brunneus, pedalis. *Sori* parvi, oblongi, superficiales, utrinque prope costam uniseriati, inter venas primarias solitarii.

CHINA. Yunnan; district of Mi-le, in mountain forests, *Henry*, 9953.

327. **Gymnogramme (Selliguea) pentaphylla,** *Baker* [Filices-Polypodiaceæ]; ad *G. ellipticam*, Baker, arcte accedit; differt pinnis paucioribus latioribus, soris brevioribus ab costam et marginem remotis.

Rhizoma epigæum, repens, paleis lanceolatis erectis sordide brunneis dense vestitum. *Lamina* deltoidea, simpliciter pinnata, 8–9 poll. longa et lata, chartacea, utrinque viridis, glabra; pinnæ bijugæ, lanceolatæ, integræ, medio 15–18 lin. latæ, e medio ad basin et apicem sensim attenuatæ; venæ in areolas copiosas irregulares hexagonas anastomasantes, venulis liberis inclusis productis; petiolus gracilis, nudus, 8–9 poll. longus. *Sori* lineares, erecto-patentes, laxe dispositi, uniseriati, inter costam et marginem mediales.

CHINA. Yunnan; Mengtze, mountains, alt. 6000 ft., *Henry*, 9033.

328. **Antrophyum stenophyllum,** *Baker* [Filices-Polypodiaceæ] ad *A. lineatum*, Kaulf., magis accedit; differt defectu costæ centralis obviæ, et soris lineas 2 longas formantibus.

Rhizoma breviter repens, paleis ovato-lanceolatis nigris clathratis vestitum. *Lamina* integra, linearis, 4–5 poll. longa, medio 3 lin. lata, ad apicem et basin sensim attenuata, subcoriacea, utrinque viridia, facie venis elevatis plicata; venæ verticales, raro anastomosantes; petiolus subnullus vel brevissimus. *Sori* sæpissime 2, paralleli, verticales, immersi, raro anastomosantes, ad apicem et basin laminæ haud producti.

CHINA. Yunnan; on rocks, Hsinkai, Red river, *Henry*, 9607.

329. **Antrophyum obovatum,** *Baker* [Filices-Polypodiaceæ]; habitu ad *A. latifolium*, Blume, accedit; soris in canalibus angustis verticalibus immersis recedit.

Rhizoma breviter repens, paleis subulatis parvis brunneis dense vestitum. *Lamina* obovato-cuneata, cuspidata, 5–6 poll. longa, medio 2–4 poll. lata, coriacea, utrinque viridis, glabra, facie plicis verticalibus rugosa, dimidio superiori rotundata, cuspidata, dimidio inferiori cuneata; venæ primariæ verticales parallelæ, sæpe anastomosantes; costa nulla; petiolus nudus, interdum semipedalis. *Sori* copiosi, immersi, ad venas decurrentes, ad apicem et basin laminæ haud producti.

CHINA. Yunnan; Mengtze, on rocks in mountain forests, alt. 5000 ft., *Henry*, 9153 A.

330. **Acrostichum (Elaphoglossum) yunnanense,** *Baker* [Filices-Polypodiaceæ]; ad *A. stigmatolepidem*, Fée, magis accedit; frondibus linearibus ad marginem paleis parvis ciliatis et paleis facialibus profunde stellatim fissis differt.

Rhizoma breviter repens, paleis lineari-subulatis castaneis erectis dense vestitum. *Lamina sterilis* simplex, linearis, subcoriacea, 6–8 poll. longa, medio 5–6 lin. lata, ad basin et apicem sensim attenuata, utrinque viridis glabra, paleis minutis peltatis pallide brunneis profunde stellatim fissis decorata, margine paleis minutis ovatis membranaceis pallide brunneis ciliata; venæ immersæ, obscuræ, erecto-patentes, simplices vel furcatæ; petiolus 12–18 lin. longus. *Lamina fertilis* 5–6 poll. longa, medio 3 lin. lata, per totam faciem inferiorem sorifera; petiolus 4–5 poll. longus.

CHINA. Yunnan; Mengtze, on mountains, alt. 5000 ft., *Henry*, 10310.

DCXXIV.—MISCELLANEOUS NOTES.

Her Majesty's Government, having determined to adopt the recommendations of the West India Commission (see *Kew Bulletin*, 1897, pp. 401–402), the necessary supplementary estimate was passed by the House of Commons on August 2. It had been decided to constitute for the purpose a new Department, to be administered by an Imperial officer, to be styled Commissioner of Agriculture. The post has been offered to and accepted by DR. MORRIS, the Assistant Director of the Royal Gardens, who had accompanied the Commission as expert adviser. The head-quarters of the Department will be at Barbados. In the course of the debate the following remarks were made by the Secretary of State for the Colonies, and by Sir Edward Grey, who had been one of the Royal Commissioners :—

EXTRACT from the "*Times*," August 3rd., 1898.

MR. CHAMBERLAIN: The ground provisions upon which the people live are not in the West Indies exchangeable products. In Jamaica the peasant proprietors exchange their products with the labourers on the sugar estates. If the sugar industry in the West Indies were destroyed, the peasant proprietors would be totally unable to exchange their products. Although it is most desirable, as far as possible, that the peasant proprietor should be encouraged, it must not be supposed that that would relieve us from difficulty. If sugar were to fail we should still find the population in great difficulty and distress. Still, we are doing all we possibly can in regard to this matter. We are seeking specially for accommodation at St. Vincent, and in other colonies in which we have Crown lands we have directed the Government to do everything in their power to enable the labouring population to establish themselves on easy terms on the land, and to report any suggestions they may make in the matter. The second suggestion of the Royal Commission is much more important,—that we should seek as far as possible to substitute partially for sugar alternative industries. No doubt there is some encouragement to believe that in the future, at any rate, this may relieve the stress of the situation, and, indeed, it will be the only hope if under any circumstances the cultivation of sugar were absolutely to fail. But, as I have said,

the Royal Commission themselves point out that any attempt to substitute other industries for sugar must be a slow process, and must proceed with the greatest caution. It is not easy to extend indefinitely the production or sale of any particular plant or produce. In the first place, it seems as though nature revenges itself in some way or other, because almost invariably the action is followed by some kind of disease or pest by which the industry is hampered and damaged, as with the coffee in Ceylon, and other industries. Not only that, but, as the demand in all these cases is limited, if you increase the production too rapidly you destroy all profit in connection with it. Still, we are bound to make the experiment, and we may be encouraged by the success attending the experiment in Jamaica, which was at one time an almost exclusively sugar-producing colony. At present only 18 per cent. of the exports of the colony are in sugar, the other exports being made up of fruit and other tropical productions; and we may agree with the recommendation of the Royal Commission, that everything should be done that can be done to promote a better knowledge of the industries likely to be successfully carried on in the West Indies and any other colonies where possible. The obstacles in the way are, in the first place, the ignorance of the population—their technical ignorance of cultivation of this special character—and the lack of communication. The fact is that the West Indies are separated, one island from the other, and all from the great markets of the world, only being related to them by communications which at the present time are very slow, imperfect and unsatisfactory. Where tropical produce is concerned speedy communication is of the first importance The recommendations of the Commission in this regard were twofold. In the first instance they suggested that a special public department should be established dealing with all questions of economic plants and botanic stations in all the islands—we propose to adopt that suggestion—and that this establishment should be placed under the direction of Dr. Morris, Assistant Director at Kew, who is marked out, as I think anyone who knows anything of Kew will admit, by special qualifications for an important position of this kind. Not only has he all the scientific and other knowledge in the possession of the authorities at Kew, but also special acquaintance with the West Indies, and if those other industries are to be successful there is no one more capable of doing it than Dr. Morris. In order to carry out this scheme, which we owe entirely to the Royal Commission—because, except in detail, I know no way of improving on their recommendation—we ask for a grant of £4,500, all the money we can spend during the present financial year. But we estimate that the annual charge will be £17,500. That will be the future demand, and it must continue if the experiment shows a prospect of success until the Colonies are once again placed in a self-supporting condition. In connexion with this there is another recommendation which is of equal importance, and that is that communication between the islands and the markets should be greatly improved. We wish to establish direct communication with Canada. We also propose to establish a line of steamers to carry fruit between the islands and New York, and, if possible, to secure better

communication between Jamaica and London, where at the present time no large fruit trade has been established with the West Indies, but where there is a market of almost unlimited extent if only communication were satisfactory. We also propose, for the sake of the islands generally and the peasant population, that intercolonial communication should be established—fortnightly communication—between the different islands. The sum we ask under this head is £5,000 for the present year—all we expect to spend during the financial year; but, as far as we can at present say, the probable estimate of future expenditure is £20,000 a year. As regards both grants and other grants which we ask from the Imperial exchequer, I have to point out that it is absolutely impossible for the Colonies to bear the cost under the present circumstances. We hope they may be in the future self-supporting, but at present it is absolutely impossible for them to do anything for themselves. If these grants were thrown on the revenue of the Colonies the only result would be that their deficit would be increased, and we should have to ask for an increased grant in aid instead of a grant in aid for communication, agriculture, and technical instruction. The advantage of taking the whole matter into our own hands is that we shall have it under our control, and we shall not be hampered by local jealousies, and shall be able to introduce something like a general scheme, which would be impossible if local Legislatures in each case had to be consulted, and local jealousies were brought into play. I regard the whole of this cost as being an expenditure intended to relieve the British Government of future charges. The object is to assist the West Indian Colonies in every possible way to provide alternative industries to sugar. If it succeeds the Colonies will again become self-supporting, and if it fails I am bound to say that we, at all events, are unable to suggest any other alternative.

Sir EDWARD GREY said: Part of the vote is a grant in aid of the agricultural department, and I am exceedingly glad to hear that Dr. Morris is to be in charge of this department. He will bring to the discharge of his duties a knowledge of tropical produce, the possibilities and conditions of the cultivation of that produce, which I do not think can be surpassed by any one. He will bring to the administration of the department the greatest ability, energy, enterprise, and devotion to work. His knowledge and assistance in reference to the prospects of the islands were of the greatest value to the Commission, and I am sure his work at the head of the department will be of the highest value to the islands, and, should the appointment become permanent, will be of increasing value year by year. So much in regard to the *personnel* of the department. The object of providing alternatives of cultivation is referred to in the report of the Commission. Though we may give relief in a pecuniary form we cannot be content with that. We ought to take what steps we can to restore prosperity, that relief may become less necessary every year, and as soon as possible cease altogether. That is the object of this part of the vote, that in the islands where the sugar industry has almost disappeared, or is likely to do so, an alternative industry may be created. In some of the islands there is a possibility of doing that at present, and in Jamaica, to which the hon. member for Northampton referred, alternative cultivation has saved the

situation, though it has not restored prosperity. The hon. member for Northampton has noticed this, and he seemed to think that what had been done in Jamaica might be done in the other islands. But it is impossible for the smaller islands to do for themselves what Jamaica has done. A first necessity is to have good communication with markets, and this the smaller islands have not. Jamaica is a larger island and the industry is more extensive in proportion, and there are easy and cheap means of communication. Dominica, St. Vincent, St. Lucia, and perhaps some of the other islands are just as suited to the growing of the fruits which have been to the advantage of Jamaica. But at the present moment, the situation is that no one will attempt to grow the fruit because they could not send the fruit to the market, and no one will provide the steam communication because there is no fruit to bring away. What is essential is cheap and rapid freight, and that steamers should call regularly. The object of this vote will be to provide steam communication, and to encourage the growth of produce.

The following correspondence records the circumstances under which Dr. Morris's long and useful connection with Kew terminates :—

Colonial Office to Office of Works.

Downing Street, August 4, 1898.

Sir,

I am directed by Mr. Secretary Chamberlain to request you to inform Mr. Akers Douglas that the House of Commons having made provision for the new Agricultural department in the West Indies, Dr. Morris has been definitely offered, and has definitely accepted, the post of Commissioner of Agriculture for the West Indies.

It is proposed that he shall vacate his present post and enter upon his new duties on the 1st of September next. It is understood that this arrangement will be convenient to the Director of the Royal Gardens, and Mr. Chamberlain trusts that it will meet with Mr. Akers Douglas' approval.

I am, etc.,

The Secretary of (Signed) C. P. Lucas.
The First Commissioner of Works.

Office of Works to Royal Gardens, Kew.

The Director of Kew,

The appointment of Dr. Morris has now been officially confirmed.

The First Commissioner regrets the loss of Dr. Morris' valuable services, but is glad that they will be retained for the furtherance of objects most important to the State, although beyond the sphere of this Department.

August 14, 1898. R. B. B.

Mr. David Tannock, at present a sub-foreman in the employ of the Royal Gardens, has been appointed by the Secretary of

State for the Colonies, on the recommendation of the Commissioner of Agriculture for the West Indies, Resident Agricultural Instructor to be attached to the Botanic Station at Dominica.

Colonial Work of Kew.—In the course of the debate in the House of Commons on August 2, the Secretary of State for the Colonies made the following reference to the services of Kew to the Colonies :—

Let me express in passing, what I think is only due—my deep sense of obligation to the authorities at Kew for the assistance they have given me in regard to the West Indies and other colonies. I believe my predecessors would heartily join me in this recognition of the services of Kew. I do not think it is too much to say that at the present time there are several of our important colonies, which owe whatever prosperity they possess to the knowledge and experience of, and the assistance given by the authorities at Kew Gardens. Thousands of letters pass every year, between the authorities at Kew and the Colonies, and they are able to place at the service of those colonies, not only the best advice and experience, but seeds and samples of economic plants capable of cultivation in the Colonies. (Cheers.)

A similar testimony to the value of this branch of the work of the establishment was given by Mr. Chamberlain's predecessor, the Marquess of Ripon (see *Kew Bulletin*, 1895, pp. 205–208).

Botanical Magazine for August.—*Cortaderia jubata*, the subject of plate 7607, was originally described as *Gynerium jubatum*. This species and a few others, including the well known Pampas Grass, *G. argenteum*, are found to be sufficiently distinct to be separated from *Gynerium*. The specimen figured was furnished by W. E. Gumbleton, Esq., in whose garden at Belgrove, County Cork, it was grown. It is a native of the Andes of Ecuador, Bolivia, and Peru. *Tchihatchewia isatidea* is a handsome Crucifer from Armenia. Seeds were received at Kew from the Imperial Botanic Gardens, St. Petersburgh, in 1896. The beautiful *Buddleia variabilis* is a native of China, where it was discovered by Dr. Augustine Henry. The drawing was made from a plant sent to Kew from the Jardin des Plantes, Paris, in 1896, which flowered outside against a wall in July, 1897. *Ledum glandulosum*, native of California and British Columbia, flowered in the Aboretum in May, 1897, the plant drawn having been raised from seeds communicated by Professor Sargent, Director of the Arnold Arboretum. The Chilian *Ribes villosum* has been grown at Kew for many years : it has golden-yellow flowers borne in dense racemes.

The Flora of China.—It is satisfactory to be able to announce that the enumeration of Chinese plants (in the *Journal of the Linnean Society*) is near completion in its original form : but a

long time must elapse before the enormous accumulation of additional material can be worked out. Dr. A. Henry has recently presented a further collection of some 2,500 numbers, which, he estimates, contains about 2,000 species. This collection is from Eastern Yunnan, and it has been roughly classified and some of the more striking novelties taken out for early publication in Hooker's *Icones Plantarum.* The novelties are numerous, but no distinct or obviously new generic type was detected in the sorting. Messrs. Bourne, Carles, Ford, and Hancock, and other correspondents, have sent smaller, though not less interesting, collections.

Incense Trees of the West Indies.—There are apparently several very distinct plants known as "Incense trees" in the West Indies:—

(1.) The most widely distributed and best known plant is *Bursera gummifera*, L. (Burseraceæ). This is the "Birch tree" of Jamaica, the "Gommier" of the Windward and Leeward Islands, and the "Turpentine tree" of St. Vincent. There are specimens in the Kew Herbarium also from Cuba, Florida, Mexico, and Guatemala. It has pinnate leaves with small precocious flowers. In his report on the forests of Jamaica, Hooper describes it as "a tree of the coast and coast ranges; a smooth-barked, erect, deciduous tree, from its clean stem and its habit of branching only at the top adapted for live telegraph posts. As a timber used in coopering." Macfadyen states that all parts of the tree produce a gum capable of being substituted for gum-mastic as a transparent varnish. In the Kew Museums there are "flambeaux" from Dominica, said to contain the resin of this tree wrapped in leaves of the Balisier (*Heliconia* sp.), and in the spathe of *Euterpe montana.* It is doubtful whether this resin in every case is really from *Bursera gummifera.* Dr. Imray, who has also sent a gum resin from *Bursera gummifera*, refers to it as "the large Gommier tree."

(2.) In order to distinguish it from the incense tree of the lowlands, there is another tree called the "Mountain incense tree," but often simply "the Gommier." This is *Dacryodes hexandra*, Griseb., also belonging to the natural order Burseraceæ. Grisebach describes it from Dominica specimens as a balsamiferous tree 10 to 15 feet high. The size here given is evidently an error. It is correctly described by Hooper in his report on the forests of Grenada and Carriacou, p. 6, as follows: "The tree locally known as 'Gommier' is also commonly represented in the forest, and grows to large dimensions, a girth of 9 feet being general with a height of 150 feet. Well grown Gommiers are found on the upper leeward slopes at the Grand Etang (1,800 feet). It is used for canoes, being hollowed out for the purpose, also in flooring and for roofing shingles." The occurrence of this tree in Grenada is referred to in the *Kew Bulletin* (1891, p. 149).

In July last, specimens of the resin of *Dacryodes hexandra*, obtained from trees growing in the Annandale Woods, Grenada, were forwarded to Kew by Mr. W. E. Broadway, Curator of the Botanic Station.

In St. Lucia, Hooper records the presence of the same tree, where he says it is known as "Gommier à canots." There are very fine specimens of resin from probably this species in the Kew Museum from St. Vincent. These were sent to the Forestry Exhibition at Edinburgh, in 1884, as "Gum opal." In Dominica, Ramage collected specimens of leaves and flowers, which are labelled "Gommier rouge," and, he adds, "rich in a very inflammable gum." There are also specimens from Martinique and Porto Rico. In 1885 the Director of the Botanical Department in Jamaica forwarded to Kew specimens received from Mrs. Kinvan, of Montserrat, of leaves and resin of a tree that Professor Oliver believed to be *Dacryodes hexandra*, with the information that a resin similar to that sent had been valued in London at 2*s.* 6*d.* per pound. The amount of resin, according to Mrs. Kinvan, ordinarily obtained in Montserrat is very small. It is possible that elsewhere, and from very old trees, it may be yielded in larger quantities. In March last, leaf specimens of the same species were received from Professor Tilden, of the Royal College of Science, South Kensington. In forwarding them to Kew for identification, Professor Tilden stated : "The resin presents some points of chemical interest, and might be of some commercial value if obtainable in quantity. It resembles Gum animi." The gums animi and copal of commerce are well-known hard fossil resins found on the East and West Coasts of Africa. They differ considerably in texture from the soft resinous gums obtainable from these West Indian trees.

(3.) A third species of West Indian incense trees is *Protium guianense*, March. This is not recorded under that name in the *Flora of the British West Indian Islands*. It is probably the plant recorded by Grisebach as *Icica heptaphylla* (p. 172). Specimens of a variety of it were received from St. Lucia from Hooper in 1886. Previously it was represented in the Kew Herbarium from St. Lucia, communicated by Anderson, and also from the collection of Bishop Goodenough, but without a locality. This plant was figured and described in *Hooker's Icones Plantarum*, t. 1571. Mr. Hooper sent it as the "Gommier l'encens," of St. Lucia.

The typical plant is indigenous to the mainland of South America, and, according to Marchand, it affords the "*Tacahamaque* (sic) *huilense incolore* and a resin called '*Encens de Cayenne*.'" A very similar resin from Venezuela in the Kew Museum is labelled "Tacamahacca." The tree was found in British Guiana by Schomburgk and Jenman. It is desirable that further inquiry be made respecting the occurrence of the plant in St. Lucia, and some of the resin said to be yielded by it might be forwarded for examination to this country.

Prices of Fine Para Rubber during each year from 1877 to 1898, inclusive, in London and Liverpool (compiled from the Lists of Messrs. Hecht Levis & Kahn.)

Wyman & Sons, Ltd.

ROYAL GARDENS, KEW.

BULLETIN

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DCXXV.—PARA RUBBER.

(*Hevea brasiliensis*, Muell. Arg.)

What is known as the Para rubber of commerce is obtained from the vast region drained by the Amazon and its tributaries estimated to embrace a territory nearly two-thirds the size of Europe.

The plants yielding Para rubber consist of several species of *Hevea* belonging to the natural order Euphorbiaceæ, familiarly known as Spurges.

We owe the first authentic account of the plants of this genus to M. de la Condamine, the leader of the French expedition sent out in 1773 to measure an arc of the meridian near Quito. The tree was known in the Andean region as "Heve" or "Jeve," but according to Spruce this name is also applied to *Castilloa elastica* and to *Siphocampylus Caoutchouc*. In the Amazon valley it was called "Cahuchu" probably the origin of the word caoutchouc. The Portuguese in Brazil call the rubber "Seringa," and the native collectors "Seringuieros." The tree is "Pao de Seringa." These names suggest that the syringe was one of the earliest uses to which india-rubber was locally applied.

Plants belonging to the genus *Hevea* are widely distributed in tropical South America. They are apparently found wild in no other part of the world. In the present state of our knowledge it is impossible to state accurately all the species that yield Para rubber.

In a review of the species of *Hevea* by Mr. W. B. Hemsley, in *Hooker's Icones Plantarum*, figures are given of *Hevea spruceana*, Muell. Arg. (t. 2570), found in North Brazil, and of *H. benthamiana*, Muell. Arg. (t. 2571), collected by Spruce on the Uaupés river in North Brazil and reported to be under cultivation in Venezuela. The floral structure of eight species are elucidated (t.t. 2573 and 2574), and the seeds of five species are carefully

compared and discriminated (t. 2575). This is the most recent revision of the Heveas, but their geographical distribution in each case is not even yet satisfactorily ascertained. In addition to those mentioned above the following are known from North Brazil : *H. rigidifolia*, Muell. Arg., *H. discolor*, Muell. Arg., and *H. lutea*, Muell. Arg. The latter is found on the Rio Negro and also in East Peru. One or two species of *Micrandra* (with simple leaves) are also known as *Seringa*, and according to Spruce, yield a milk containing caoutchouc.

It is admitted that the chief species yielding the Para rubber of commerce is *Hevea brasiliensis*, Muell. Arg. (Siphonia brasiliensis, *H. B. K.*) the *Seringa* of the Portuguese and the Para rubber tree of the English. This is a slender tree reaching a height of 50 to 60 feet with a circumference near the base of 6 to 8 feet. The leaves are digitate-trifoliate on long slender petioles. The diclinous flowers are produced in axillary panicles, the female larger and terminal. The fruit is a dry capsule splitting into three one-seeded pieces. The seeds are round-oblong about an inch in length, with a brown polished testa, mottled with dark blotches. (*Collins' Caoutchouc*, t. 1 ; *Hooker's Icones Plantarum*, t. 2575, figs. 1–7 ; Siphonia brasiliensis *Hayne's Gewache*, xiv., t. 5).

In a report recently furnished to the Foreign Office, by Mr. Consul W. A. Churchill (*F.O.* No. 2140, Annual Series, Trade of Para and district for the year 1897) the following account is given of this rubber tree (pp. 25, 26.)

" The *Hevea* tree is not conspicuous, and resembles many other forest trees. People have travelled for thousands of miles through the rubber region and have lived for years in the centres of the industry without even noticing it. The new-comer invariably expects to see the familiar glossy dark-green leaves of the *Ficus*, and is dissappointed with the insignificant appearance of the *Hevea*. In habit it is more like the English ash than anything else. It grows to a height of upwards of 60 feet.

" The localities where rubber-trees thrive the best are on islands and low ground near rivers where the banks are periodically inundated. Ground that is above water at all times or that has no drainage is not so suitable to the tree.

" A peculiarity of this rubber-tree is, that it will not grow satisfactorily on cleared and open ground. It requires the shade of other trees, and still air, from the time that its growth begins until it becomes an adult tree. Without these conditions the supply of milk is very much affected. In fact, the tree has been known to die soon after the clearing of ground around it.

" No cultivation of rubber trees worth mentioning has been attempted in the Amazons region. It is considered useless to invest capital in cultivation so long as the Amazonian forests show no sign of exhaustion."

A very interesting note on the early history of the india-rubber industry on the Amazon was communicated by R. Spruce to *Hooker's Journal of Botany* (vol. vii., 1855, pp. 193–196). This gives a graphic account of the beginning of the collection and preparation of Para rubber.

" When I ascended the Rio Negro in 1851, I pointed out to the inhabitants the abundance of seringa trees they possessed in their forests, and tried to induce them to set about extracting the gum ;

but they shook their heads, and said it would never answer. At length the demand for india-rubber, especially from the United States, began to exceed the supply; the price consequently rose rapidly, until early in 1854 it reached the extravagant sum of 38 milreis the arroba (2*s.* 9*d.* per pound). This woke up the people from their apathy and the impulse once given, extended so rapidly and widely, that nearly throughout the Amazon and its principal tributaries the mass of the population put itself into motion to search out and fabricate *seringa.* In the province of Para alone (which now includes a very small portion of the Amazon) it was computed that 25,000 persons were employed in that branch of industry in the year 1854. Mechanics threw aside their tools, sugar-makers deserted their engenhos, and Indians their roças; so that sugar, rum, and even farinha, were not produced in sufficient quantity for the consumption of the province, the two former articles having to be imported from Maranham and Pernambuco, and the last from the river Uaupés."

The next authentic account is a "Report on the investigation and collecting of plants and seeds of the india-rubber trees of Para, &c," by Robert Cross, presented to the Under Secretary of State for India in 1877. Extracts from this are given below.

Mr. Churchill's report already cited contains the latest and most authentic information in regard to the Para rubber industry.

"Out of a revenue of £428,894 collected on exports in the State of Para in 1896–97, £415,295 was collected on rubber alone. The export duty is 23 per cent.

"The entire Amazonian crop of 1895–96 amounted to 20,981 tons, whereas that of 1896–97 reached 22,315 tons, an increase of 6·4 per cent. The crop of the State of Para during 1896–97 amounted to 8,844 tons."

The sources of the rubber supply of the Amazonian region are approximately given by Mr. Consul Churchill, as follows:—

Sources.	Quantity.
From River Purús	3,500 Tons.
" " Madeira	2,200 "
" " Juruá	2,100 "
" " Solimöes	1,000 "
" " Negro	700 "
" " Javary and Port of Iquitos	1,500 "
" Peru and Bolivia (Caucho)	2,000 "
" Para	9,000 "
Approximate annual production	22,000 "

"The internal water communication afforded by the river Amazon and its numerous branches is so great that railroads and other means of transport are hardly needed. Ocean steamers can reach Manaos, which is about 1,000 miles from the sea, at all times of the year. There is a regular service of ocean steamers plying during high river as far as Iquitos, a port of Peru, which is 2,200 miles from the mouth of the Amazons."

Mr. Churchill continues: "The great demand for rubber and the ever-increasing prices for it have the natural result of attracting the bulk of the people to this remunerative industry. So long as the demand for rubber continues the prospects as regards the development of agricultural industry will be comparatively insignificant."

It follows that the rich lands of the Amazon valley are practically untouched except to tap the wild rubber trees growing upon them. Nearly all the necessaries of life are imported from other countries.

The town of Para or Belem the headquarters of the great rubber industry of the Amazon region is on the right bank of the river Guama and about 100 miles from the sea.

It is not on the banks of the Amazons, but is connected with the latter by a labyrinth of narrow channels through which passes all the shipping between the outer world and the numerous Amazonian ports inland. The true mouth of the Amazons is dangerous to navigation and is avoided. Hence the port of Para commands practically the whole Amazon region and is the emporium where is transacted the largest india-rubber business in the world.

According to Mr. Churchill, during the year 1897, the distribution of Amazonian rubber from Para was as follows :—

United Kingdom	8,843	tons.
France	2,010	„
Italy	65	„
U.S. America	11,626	„
Total ...	22,544	„

Locality, Soil, and Climate.

Para is in about south latitude 1°, but the district of the same name extends over a vast forest region to the south and west, throughout which and the enormous forests of Central and Northern Brazil the rubber trees are abundantly found. The climate has been often described and is remarkable for its uniformity of temperature, usually not exceeding 87° F. at mid-day or below 74° at night. The greatest heat recorded is 95°, and the mean for the year is 81°.

The rainfall occurs principally during the months from January to June, the maximum being in April when it reaches 15 inches. For the remaining six months of the year very little falls, but there are fine days in the wet season and occasional showers in the dry. The whole country is covered with dense moist forests, and the soil near the numerous and gigantic rivers is deep, heavy, and very fertile. During the wet season much of the low-lying country near the Amazon's mouths is flooded. In the *gapos* near Para, visited by Mr. Cross, he found a flat district only three or four feet above the highest tides and completely intersected with water-courses at low tide, filled with a soft rich mud. The forest here, in which caoutchouc collecting was vigorously carried on, was 80 or 100 feet high, and very damp and unhealthy, the

soil full of moisture and very rich and fertile. The young plants, however, were not often observed to grow actually within the reach of the tides, but it is evident that they must occasionally be partially covered with water.

Propagation.

The most convenient means for propagating Para rubber trees is by seeds. As might be expected seeds are difficult to collect in the dense growth of the Amazonian forests. There is further no certainty that they are sound. On the other hand seeds are very readily obtained from cultivated trees now distributed over many parts of the tropics. If quite fresh they bear transport for a period of three or four weeks. Seeds forwarded from Ceylon to Kew in canvas bags have germinated to the extent of 95 per cent. If special precautions are necessary they may be packed in soil or cocoa-nut fibre moderately dry. The disappointment sometimes experienced in despatching Para rubber seeds is due to the fact that the seeds have not been quite fresh when packed. It is absolutely necessary that they be packed within a day or two of the time they have been gathered. Where this is done the seeds, if sound, should bear transport for three weeks at least. The other method of propagating the tree is by cuttings. These cuttings may be taken from the green lateral twigs as soon as they begin to harden ; they strike readily in rich firm soil. Mr. Cross (p. 8) observes that "for planting on inundated lands the period of high flood should be preferred. Cuttings of greater length would be required in this case, the lower ends of which should be sliced off in the form of a wedge. The workman could take a bundle of these, and wading into the water would plant at proper distances, but perfectly upright, taking care to push each cutting down deep enough in the soft muddy bottom, so that not more than three or four inches is above the surface of the water. The same rule would be applicable when planting in sludge or soft marsh land. The crowns of the cuttings must not, if possible, be put under water, as the young growths springing therefrom might rot. Seeds will not be found very applicable for planting in watery places or deep mud deposits. Some would come up, but a good many would mould and decay. In the varied course of circumstances and conditions, slight changes and modifications in the methods of working will no doubt suggest themselves. . . . . It should be planted in places where nothing else could be profitably cultivated, such as frequently inundated river margins, marsh land, and mud deposits." These remarks, it should be noted, apply only to the Amazon region. In other parts of the world Para trees have been found very impatient of floods, and have actually been killed by being planted within their reach. Again, it would not be desirable to form a plantation in any locality where the temperature at any time falls to 60° F.

The tree when fully grown does not exceed a height of about sixty feet, and the largest trunk measured by Mr. Cross was six feet ten inches in circumference at a yard from the ground. From the upright habit of the tree it will not be necessary to plant at any great distance apart.

Collection of Rubber.

Several accounts have been given of this; the fullest is that of Mr. Cross, who saw in practice the methods employed in the neighbourhood of Para. His description (p. 4) is as follows:—

"The collectors begin to work immediately at daybreak, or as soon as they can see to move about among the trees. They say the milk flows more freely and in greater quantity at early morn. I do not attach much importance to this statement, but I have recorded it. Another and more probable reason is that as rain often falls about two or three o'clock in the afternoon the tapping must be done early, as in the event of a shower the milk would be spattered about and lost. The collector, first of all, at the beginning of the dry season goes round and lays at the base of each tree a certain number of small cups of burnt clay. At the lesser trees only three or four are put, but at the larger ones from eight to twelve are deposited. The footpaths leading from tree to tree are likewise cleared of sapling growths, and the bridges over the *gapos* (natural ditches), formed at each place by the trunk of a tree, are, where necessary, replaced. On proceeding to his work the collector takes with him a small axe for tapping, and a wicker basket containing a good-sized ball of well-wrought clay. He usually has likewise a bag for the waste droppings, and for what may adhere to the bottoms of the cups. These promiscuous gatherings are termed *sernamby*, and form the 'negrohead' of the English market. The cups, as already stated, are of burnt clay, and are sometimes round, but more frequently flat or slightly concave on one side, so as to stick easily with a small portion of clay pressed against the trunk of the tree. The contents of fifteen cups make one English Imperial pint. Arriving at a tree the collector takes the axe in his right hand, and, striking in an upward direction as high as he can reach, makes a deep upward sloping cut across the trunk, which always goes through the bark, and penetrates an inch or more into the wood. The cut is an inch in breadth. Frequently a small portion of bark breaks off from the upper side, and occasionally a thin splinter of wood is also raised. Quickly stooping down he takes a cup, and, pasting on a small quantity of clay on the flat side, presses it to the trunk close beneath the cut. By this time the milk, which is of dazzling whiteness, is beginning to exude, so that if requisite he so smooths the clay that it may trickle direct into the cup. At a distance of four or five inches, but at the same height, another cup is luted on, and so the process is continued until a row of cups encircle the tree at a height of about six feet from the ground. Tree after tree is treated in like manner until the tapping required for the day is finished. This work should be concluded by nine or ten o'clock in the morning, because the milk continues to exude slowly from the cuts for three hours, or perhaps longer. I may state that there is a great difference among collectors in the performance of these duties. Some take care to get good clay previously, and incorporate it well, so that a very small portion is needed to lute the cup to the trunk. They also work with neatness and intelligence, and invariably collect a good quantity of milk. Others, again, do not take the trouble to prepare clay

beforehand, but merely scrape up a handful when they require it at the side of a *gapo*, which is often of little consistence, so that a large quantity is required to fasten the cups. This class of collectors have often many fragments of clay or other impurities in their milk, the result of not following a proper method of working. The quantity of milk that flows from each cut varies, but if the tree is large, and has not been much tapped, the majority of the cups will be more than half full, and occasionally a few may be filled to the brim. But if the tree is much gnarled from tapping, whether it grows in the rich sludge of the *gapo* or dry land, many of the cups will be found to contain only about a tablespoonful of milk, and sometimes hardly that. On the following morning the operation is performed in the same way, only that the cuts or gashes beneath which the cups are placed are made from six to eight inches lower down the trunks than those of the previous day. Thus each day brings the cups gradually lower until the ground is reached. The collector then begins as high as he can reach, and descends as before, taking care, however, to make his cuts in separate places from those previously made. If the yield of milk from a tree is great, two rows of cups are put on at once, the one as high as can be reached, and the other at the surface of the ground, and in the course of working the upper row descending daily six or eight inches, while the lower one ascends the same distance, both rows in a few days come together. When the produce of milk diminishes in long-wrought trees, two or three cups are put on various parts of the trunk where the bark is thickest. Although many of the trees of this class are large, the quantity of milk obtained is surprisingly little. This state of things is not the result of overtapping, as some have stated. Indeed, I do not believe it possible to overtap a tree if in the operation the wood is not left bare or injured. But at every stroke the collector's axe enters the wood, and the energies of the tree are required in forming new layers to cover those numerous wounds. The best milk-yielding tree I examined had the marks of twelve rows of cups which had already been put on this season. The rows were only six inches apart, and in each row there were six cups, so that the total number of wood cuts within the space of three months amounted to 72. It grew close to a *gapo*, only eight inches above high-tide mark, and being a vigorous tree the cups were usually well filled, but with two years or so of such treatment the tree would probably be permanently injured. It has been supposed that the quality of the milk is better in the dry season than during the rains. Such is the case with some vegetable products, but as regards india-rubber there ought not, I think, to be any appreciable difference. In the rainy season the milk probably contains a greater proportion of water, but, on the other hand, I am of opinion that then a larger quantity of milk flows from the tree. No doubt the dry season is the most suitable for caoutchouc collecting, although, wherever a plantation is formed with preparing house, convenient tapping may certainly be always carried on when the weather is fine . . . . There are two other methods adopted in tapping, which are chiefly confined to the Upper Amazon and tributaries. Both are exactly on the same

principle, the materials used being only a little different. The loose outside bark of the tree is cleaned off to a height of about three feet. Beneath, a gutter or raised border of clay is pasted or luted to the trunk, enclosing one-half of the entire circumference. Cuts are thickly made in the bark above this, from which the milk flows down to the gutter, whence it is conveyed to fall into a calabash conveniently placed. The other mode is by winding round the trunk the stout flexible stem of a climber, and claying it round securely, so that no milk may escape between the trunk and the climber. These plans are not extensively adopted, and can only be successfully put in practice where the trees have not been previously tapped. There is always a great deal of 'negrohead,' the result of the distance the milk has to run, and of the large quantity of clay employed in the process.

"Going from tree to tree at a sort of running pace, the collector empties the contents into a large calabash, which he carries in his hand. As he pours the milk out of each cup he draws his thumb or forefinger over the bottom to clean out some which otherwise would adhere. Indeed, a small quantity does remain, which is afterwards pulled off and classed as *sernamby.* The cups on being emptied are laid in a little heap at the base of each tree to be ready for the following morning. The trees occur at various distances from 10 to 100 yards apart, and, as I travelled over the intricate network of muddy footpaths, I continually felt perplexed and surprised that the natives had not yet seen the advantages that would be derived by forming plantations, whereby more than twice the quantity of caoutchouc might be collected in one-fourth the time, and at far less cost and labour."

The trees are tapped if they have a circumference of eighteen or twenty-four inches, and the rough process above described is carried on for many years, until the constant and extensive injury to the young wood causes their death, for some years previous to which event they almost cease to yield milk and are practically abandoned.

It will be advisable, in order to avoid this injury, to employ an instrument for cutting so shaped and guarded that it shall not be able to penetrate beneath the inner bark. With this precaution it will probably be found unnecessary to rest the trees as has been recommended ; but actual experience alone can decide on the method of tapping which will secure the greatest yield with the least damage to the tree's general vitality.

Preparation of Rubber.

The preparation of Para rubber has often been described. The process that turns out the best quality of rubber depends merely on a cheap and accessible supply of labour. The implements used are very simple. So far no rubber is so good as that prepared by smoking over a fire of palm-nuts. As suggested by Mr. Biffen, coagulation is partly due to the acetic acid contained in the smoke (*Kew Bulletin*, 1898, pp. 177–181). This also tends to preserve the rubber from fermentation during transit. The belief in the efficacy of the smoking process is so strong that even when the purest rubber is obtained from cultivated trees in Ceylon and the Straits Settlements the prices quoted are always below those

of smoke-cured Para. The following graphic account of the preparation of Para rubber is taken from Wells' "Voice of Urbano" (London: Allen, 1888):—

"Master and men then departed to various out-buildings, where the Indian boys and women, after partaking of a very hasty and meagre repast of dried piraurucu (a large river fish) and farinha, were set to work at converting the milk, or sap of the rubber tree, into india-rubber.

"This process does not require any great manual labour; it is rather a work of patience. In a distant corner of the yard, under the shade of one of the few remaining trees, a quantity of the fruit of the Urucuri palm was burning on several fires. The burning of these nuts produces a dense black smoke, the acidulous properties of which has proved to be the most efficacious for rapidly coagulating the sap of the rubber tree. Near each fire, one of the large earthenware pots was placed between a couple of Indian boys, each boy having a small, round-bladed paddle in his hand; the blade of the paddle is dipped into the milk, which, adhering to the wood, is held in the smoke of Urucuri, and rapidly coagulated and turned almost at once to the black india-rubber of commerce. The round blade of the paddle, covered with a thin coating of rubber, is then again dipped into the pot of sap, and the process repeated and continued until the rubber is about two inches thick, when one of the attendant drivers, who superintends the operations, makes a cut with a sharp knife along the outer circumference of the paddle, when the round cake of rubber is easily removed, and then placed with others on the ground alongside the operator. So the process is continued, until the collected sap is exhausted and the rubber stored away.

"Early the next morning, the Indians will again go away in the canoes to the forest, there to empty out the contents of the tins that have been previously left adhering to the rubber trees by a dab of clay below a gash in the bark, whence the milk slowly drops into the tin pans. The pan, when emptied, is then replaced or affixed to another part of the trunk, or removed altogether to some other tree. It depends on the collector whether he completely exhausts the tree of its sap and thus destroys it, or only takes a quantity—about 16 lbs.—which a well-grown tree will allow to be taken from it without detriment. In the case of Ignacio's men, all the sap that it was possible to obtain was taken from every tree (pp. 119–120)."

In the Museum No. 1 at Kew there is shown (in case 93 on the ground floor) a complete series of specimens illustrative of the Para rubber industry.

In the early stages, when the rubber was exported in small quantities, it appeared in the form of shoes or the grotesque form of animals; the better qualities came in the form of bottles moulded over soft clay, which was afterwards washed out by water. The flat, rounded cakes prepared by being smoked on paddles in the manner described above are known as fine Para or "biscuit" rubber. This is classed, according to the localities in which it is produced, as "Islands" and "Up-river," or as "hard-cured" and "soft-cured." The medium qualities are called *entrefine*, in which there are occasionally some streaks of white

uncoagulated milk or an excess of moisture, while the uncured scrapings from the trees, mixed with the residues from the collecting pots and vessels, are made up into large, irregularly rounded balls and form a third grade known as "sernamby" or "negro-head"—the latter from the fancied resemblance of the mass to the head of a negro.

The illustrations of implements used in the preparation of Para rubber here given were prepared from articles in the Kew Museum, and are kindly lent by the Editor of the *Pharmaceutical Journal*:—

ARTICLES USED IN COLLECTING AND PREPARING PARA RUBBER (*Hevea*) IN BRAZIL.

A. Small axe with cutting edge about 1 inch wide.

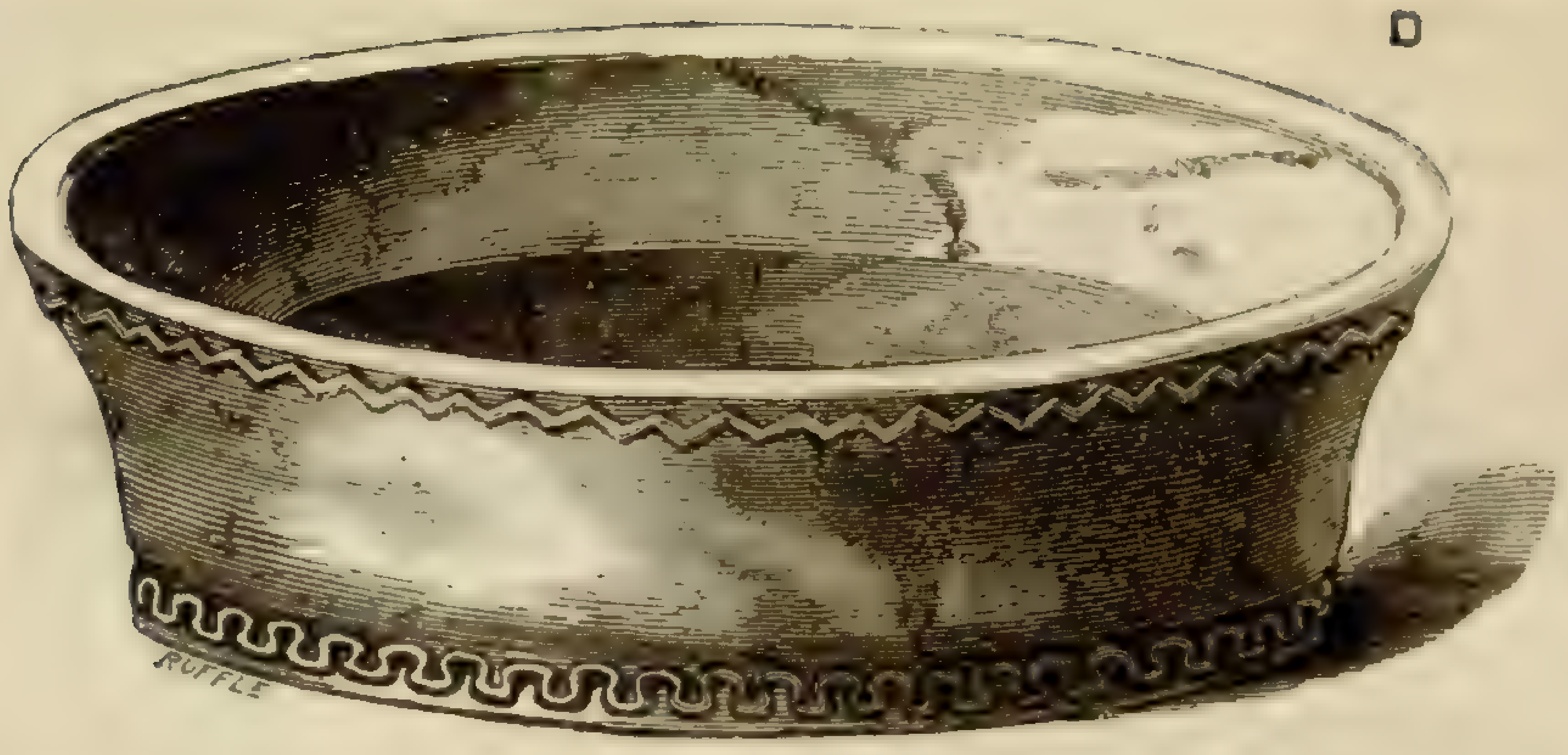
B. Small earthenware cup placed below incision to receive the latex.

C. Calabash carried by the seringuiero, in which is collected the latex from the small cups.

E. Portion of a calabash used to pour the latex over the paddle.

F. Wooden paddles—to the right before use, to the left with a first layer of cured rubber.

H. Cutlass used to collect the nuts of the Urucuri palm (*Maximiliana regia*).



D. Large earthenware pan into which the day's collection of latex is poured preparatory to coagulation.

G. Earthenware stove under which a fire of palm nuts is kept up. The latex on the paddle after exposure to the heat and smoke, emerging at the top, is coagulated and assumes a firm texture and dark colour.

Future Prospects.

Mr. Churchill discusses these as follows (p. 26) :—

" Some people suppose that the supply of Amazonian rubber may become exhausted in the near future. The most competent authorities are not at all of this opinion, but maintain that the supply is inexhaustible, because the *Hevea* is continually being reproduced by nature. Certainly some areas become exhausted when overworked, but when left alone for some time they recover. The district of Cametá, on the River Tocantins, gave an excellent quality of rubber. There was a special quotation for it in the foreign markets. This district, however, is now exhausted, because for about 40 years, thousands of men have tapped its trees. All new-comers flocked to Cametá to make their fortunes. There are still many districts that have not been tapped.

" The area that is known to produce Para rubber amounts to at least 1,000,000 square miles. Further exploration will, no doubt, show that this area is under-estimated.

"The richest zones as at present known are along the banks of all the southern tributaries of the River Amazons, and on the islands in the main stream and near Pará.

"The most prolific part is on the River Aquiry or Acré, one of the tributaries of the River Purús. Here 100 trees yield as much as one ton of rubber per annum.

"The northern tributaries of the Amazons do not produce much rubber. Of these, the River Negro produces the most. The quality, however, is soft. The River Branco yields very little rubber, and the upper part runs through pasture lands and high ground which is not suitable for good rubber. Some of the other northern tributaries have not been explored, and may yet reveal large stores of rubber. The *Hevea* is known to exist on the banks of the Japurá, but that district has not yet been opened up."

Bolivian Rubber.

The following interesting particulars respecting the yield of Hevea rubber in Bolivia are taken from a Report to the Foreign Office (*F.O.*, Annual, 1897, No. 1841) by Mr. Consul A. St. John :—

"Nearly the whole of the india-rubber collected in Bolivia goes to England *viâ* Para. On the spot it is worth from 22 to 25 Bol. per arroba of 25 lbs. Through the Bolivian custom-house of Villa Bella on the Brazilian frontier, 69,040 arrobas were exported in 1894, viz., 63,663 arrobas of fine rubber, and 5,377 arrobas of the inferior kind known as Sernamby.

"During that year, about 3,400 arrobas are said to have been exported through La Paz (Puerto Perez), whilst 3,000 or 4,000 arrobas are said to have been exported through Puerto Suarez on the Paraguayan frontier. *Hevea brasiliensis*, the tree which yields this valuable sap, abounds in the virgin forests of Bolivia.

"If these figures be correct, and no contraband trade in that article be carried on, the annual production may be estimated at present at about 850 tons. The duty on fine rubber is 1 Bol. per arroba and 50 c. on sernamby."

Some Bolivian rubber is shipped from the Port of Mollendo on the Peruvian coast. It is brought by rail from Lake Titicaca, and obtained from that portion of Bolivia which lies above the navigable portions of the River Beni. "Mollendo rubber" has only made its appearance during the last three or four years. It takes rank with good Para rubber, and commands almost identical prices. In Messrs. S. Figgis & Co.'s report, dated the 8th July, 1898, is mentioned :—"Mollendo" : 7 packages sold, fine, 3*s.* 11½*d.*; entrefine gutty, 3*s.* 10*d.*; negrohead, good, 3*s.* 2¾*d.*

Introduction of Para Rubber Tree to the Old World.

The introduction of the rubber-yielding trees of tropical America to British Possessions in the East was an enterprise in which, more than twenty years ago, Kew took an active part. The expense was entirely borne by the Government of India. The record of the steps taken in regard to Para rubber is given in the *Kew Reports* (1875, p. 7; 1876, pp. 8 and 9; 1877, p. 15, and 1878, p. 14).

A concise summary, published by Dr. Trimen in the Appendix to the Report of the New Products Commission (Sessional Papers, Ceylon, 1881, No. 13, p. 9), is reproduced below :—

"I am desirous of taking this opportunity of putting upon record something of the history of the introduction of the valuable Para rubber into the East, which has been effected at a large cost and with much trouble. When the Government of India had determined upon the enterprise, a commission was given to Mr. Wickham, then living at Santarem, to collect seed at the rate of £10 per 1000. He succeeded in obtaining 70,000 seeds in the Siringals of the Rio Tapajos, which he packed with the greatest care and with a full knowledge of their evanescent vitality; and coming straight home with them arrived at Kew on 14th June, 1876. The following day the whole number was sown; not more, however, than "about $3\frac{3}{4}$ per cent. germinated, some as early as the fourth day after sowing; and many in a few days reached a height of 18 inches."—(*Kew Report*, 1876). At Sir Joseph Hooker's suggestion, it had been previously arranged between the India and Colonial Offices that owing to the want of any accessible and properly constituted Botanical Garden in any part of India suitable for the growth of this completely tropical species, the seedlings should be sent to Ceylon to be cultivated and propagated for subsequent distributions to Burma, and other hot and moist districts of the Indian Empire. Owing to the plants' rapid growth, wardian cases of a special form had to be made for their transmission, and, on August 12th, thirty-eight of these, containing 1,919 plants, were despatched from Kew in charge of a gardener (W. Chapman). In due course they were received at Peradeniya in very good order.

"Mr. Cross's share in the introduction of Para rubber was a very small one. He, also, had been sent by the Indian Government to South America to bring home live plants in case the transmission of living seed should prove impossible, and he arrived at Kew on 21st November, 1876. He brought with him about 1,080 seedlings without soil, of which, with the greatest care, scarcely three per cent. could be saved. About 100 plants propagated at Kew from these were subsequently sent to Ceylon.

"The cost of procuring the seeds of Para rubber, freight and other expenses, appears to have been no less than £1,505 4*s*. 2*d*., the wardian cases alone costing £120, and the gardener and his passage £163. The whole of this large expenditure was borne by the Indian Government. An undertaking involving such an outlay as this, it is obviously beyond the power of the Executive of this Colony to carry out; but in this case, it is Ceylon which (from climatic causes chiefly) appears likely to benefit most largely from the successful action of the Government of India."

Experimental Planting in Ceylon.

As Ceylon was adopted as the central point in the East Indies for the cultivation and distribution of the rubber plants introduced by the Government of India from tropical America, this island naturally took an active part in starting experimental plantations.

A concise summary of the results attained up to the end of 1894 was prepared for Kew by the late Dr. Trimen, and as it contains observations made by a competent and experienced officer for many years in actual charge of the experiments, it is a valuable record :

"In October, 1876, Dr. Thwaites being at that time Director, there were received at Peradeniya from Kew, in charge of a gardener, Mr. W. Chapman, 38 wardian cases containing some hundreds of young seedlings of *Hevea brasiliensis*, in excellent condition."

"The seedlings were at once planted in bamboo pots, and in the rainy season of the following year, 1877, were transferred from Peradeniya to the new ground acquired for the purpose in the low-country at Henaratgoda. Here they were planted out, and at once began to grow with great rapidity. Propagation by cuttings was commenced in order to send supplies to India, which was done in 1878 and 1879 ; and a moderate distribution was also made by Dr. Thwaites to planters in Ceylon.

"On my arrival here in February, 1880 I found at Henaratgoda about 300 of the original seedlings, tall slender trees four years old, the tallest about 30 feet high, and at Peradeniya about 20 trees, smaller and less luxuriant in growth. Since that time the number has been increased, mostly by cuttings, and now consists of about 424 seed-bearing trees at the low-country garden, and 30 at Peradeniya.

"The rate of growth of the stem during this period is shown in the following table, the measurements being taken from one of the best grown of the original seedlings at Henaratgoda :—

	ft.	in.		ft.	in.
End of 1880	1	4	End of 1888	5	0
,, 1881	1	9	,, 1889	5	0
,, 1882	2	1½	,, 1890	5	9¾
,, 1883	2	6	,, 1891	6	1
,, 1884	3	0	,, 1892	6	5
,, 1885	3	7	,, 1893	6	7½
,, 1886	4	1	,, 1894	6	8
,, 1887	4	5½			

The circumference was taken at a level of 3 feet from the base. I doubt if the trees will increase much more in girth, as Mr. Cross states that the largest he measured in Brazil was but 6 feet 10 inches. The trunks are straight and tall, and the branches short, so that the trees do not occupy much space.

"The first flowering occurred at Henaratgoda in April, 1881, and a few (36) seeds were secured that year ; at Peradeniya there were no flowers till 1884. The tree does not seed profusely and it was not till 1887 that any large quantity was produced. Till that year they were for the most part sown in nurseries, and the young plants distributed in Ceylon to Government Officers and a few planters for trial. But as soon as larger crops of seeds were produced we were able to comply with official requests for seed from other Colonies (see below), and I was able, also, to advertise their sale at a low price to the planting community generally. Thus we have distributed in Ceylon :—

	seeds.		seeds
1889	8,000	1893	90,000
1891	15,000	1894	86,000
1892	16,000		

A large number of estates in the low-country have now plantations of young seedling trees, and some must be themselves producing seed.

"As far back as 1882 I urged on Government the desirability of forming large plantations of this valuable tree in the South of the island, but as at that time there was no Forest Department here, nothing was done. Again, in 1888, after the favourable reports of the quality of rubber produced by Ceylon-grown trees, I again advocated this cultivation by Government, and in the next year, 1889, the lately formed Forest Department selected land in the Province of Sabaragamuwa. In 1890 a small commencement in planting this was made, the Gardens supplying 9,000 seeds for the purpose, followed in 1891 by 20,000 seeds and 2,000 stumped plants, and in 1892 by 30,000 seeds. We have had no requests for any further supply, but I understand it is the intention of Government to form another plantation this year.

"Mr. F. Lewis, of the Forest Department (under whose charge the plantation is placed), has kindly given me a full report of the progress of the trees, from which I extract the following particulars. The land selected in May, 1890, is at a place called Edangoda, on the north bank of the Kaluganga River, and is under 100 feet above sea-level. It is 20 acres in extent ; the rain-fall is very heavy, approximately 150–170 inches per annum. At that time it was believed, owing to Mr. Cross's description of the locality of the wild trees in Brazil, that land occasionally flooded would be very suitable for this plant, and accordingly the site selected had its lower portion annually covered with water when the river was in flood. It was, however, found that three days' flooding was sufficient to completely kill all the young plants, and after a second trial in the next year, with the same result, this portion of the land was abandoned. The seedlings, in the small bamboo baskets in which they had been raised, were planted out at intervals of 12 feet. In 1891 further land was selected at a place called Yattipowa, 37 acres in extent, at a rather higher level on the same river, and not liable to flood, being raised in the centre and sloping east and west ; this was planted up in the same manner. It was necessary to weed carefully for the first two years, after which the young trees produced sufficient leaf-canopy to keep this vegetation down. They grew at a great pace, some reaching 16 feet high in the first year, branching usually occurring in the second. At the end of 1893 a few of those first planted fruited, and the seed produced was successfully germinated.

"Measurements taken recently (December 1894) of average sample plots from each plantation give the following mean girth, at 3 feet from the ground :—

At Edangoda	(4 years old)	average of 100 trees	... ...	12.96 ins.
"	(3 ")	" 50 "	... ...	8.75 "
"	(2 ")	" 20 "	... ...	4.96 "
At Yattipowa	(3 ")	" 108 "	on western slope	9.37 "
"	(")	" 108 "	on eastern slope	9.13 "

the difference in the last measurements being due to amount of exposure to wind.

"My first experimental tapping was made in October, 1882, of five trees, then six years old ; and about 2½ ounces only of dry

rubber was obtained. This small sample was sent home and reported by Messrs. Silver to be 'fully equal to good Para India-rubber as regards strength and elasticity,' and to be worth 4*s.* per lb. This was quite satisfactory as to quality, but it was obvious that the trees were yet too young to afford any quantity of milk. I therefore deferred any further tapping for a few years, till 1888, when the trees were 11 years old. One of the best-grown and healthiest was then selected, having a stem circumference of 4 ft. 2½ ins. at a yard from the ground. The plan followed was to scrape off a little of the rough outer bark and to make V-shaped incisions with a ¾-inch chisel in the inner bark. The milk mostly dried on the tree in tears, thick strings and small sheets, and that which ran down the trunk was prevented from reaching the ground by little cups of cocoanut-shell fastened with clay to its base. The operation was performed on 17 days in the driest months of the year and the whole amount of dry rubber obtained was 1 lb. 12¾ ozs.; the time occupied was in all about 20 hours and the cost estimated at 62 cts. of a rupee. Though the bark was of course much scarred with the numerous incisions, the tree in no way suffered from the process. I, however, allowed it to remain untouched in 1889 and the bark to heal over, but it has been again treated in 1890, 1892 and 1894 with the following results :—In 1888 gave 1 lb. 11¾ ozs.; in 1890 gave 2 lbs. 10 ozs.; in 1892 gave 2 lbs. 13 ozs.; in 1894 gave 3 lbs. 3 ozs., being a total of 10 lbs. 7¼ ozs. On a sample of this rubber sent home in February, 1893, Messrs. Hecht, Levis & Kahn, reported that it was 'very good indeed' its value at that date being from 2*s.* 3*d.* to 2*s.* 6*d.* per lb. easily saleable in any quantity.

"A yield of over 10½ lbs. of first-class rubber from a single tree in six years fully warrants a belief that the cultivation of large plantations would be highly profitable. Nor is there any reason to suppose that the trees would not easily bear tapping annually, and continue to yield for very many years if the wood were not injured. I do not think they should be bled, however, until at least 10 years old. It is noticeable how rapidly the yield increases with age.

"In India the only localities in which the tree has been found to succeed are Lower Burma and Malabar, and to Forest Departments in both districts, Mergui in the former and Nilambur in the latter, seeds and plants have been largely sent from Ceylon, as follows :—

To Burma (Mergui),	1878	...	Plants (rooted cuttings)	500
" "	1887	...	Seeds.	
To Malabar (Nilambur),	1878	...	Plants (rooted cuttings).	
" "	1879	...	" (" ")	33
" "	1883	...	" (stumps)	27
" "	1884	...	" (")	26
" "	"	...	Seeds.	
" "	1885	...	"	300
" "	1887	...	"	

"In 1880 we sent two plants to the First Prince of Travancore in 1881 a Wardian case of 28 plants to the Andaman Islands, and in 1888 about 3,000 seeds to the Commissioner of Agriculture at Nagpur, Central Provinces.

"We have also been able to comply with the requests for seed received from the Governments of several British Colonies, and in 1887 and 1888 we despatched to :—

Singapore (1888)	11,500 seeds.
Penang (1887)	Seeds.
Fiji (1888)	1,100 seeds.
Queensland (1887)	Seeds.
North Borneo	40 plants.
Jamaica (through Kew, 1887)	2,000 seeds.
" (" " 1893)	200 seeds.

We have also supplied seeds to the Botanic Gardens at Buitenzorg, Java, and to the German East African Company.

"HENRY TRIMEN."

At the beginning of the present year Dr. Trimen's successor, Mr. John C. Willis, F.L.S., issued a Circular (No. 4) in which he continues the record of rubber cultivation in Ceylon. The points dealt with in the following extract deserve a wider circulation than they are likely to obtain in the Circular :—

"The Para rubber trees planted in 1877 at the Henaratgoda Garden are now very fine trees, with an average height of about 60 ft., and average girth at 6ft. above the ground of 4 ft. From their seed other plantations have been made in the Botanic Gardens, and also by the Forest Department. A large quantity of seed has been sold to private planters since 1886. There are about 450 trees in the Botanic Gardens, producing about 100,000 seeds per annum.

"The number of trees on private estates in Ceylon is probably about 200,000, of various ages from one to twelve years. This number represents an area of about 750 acres.

"*Soil.*—In its native country *Hevea* is a jungle tree usually growing in deep, rich, alluvial soil which is liable to be flooded during the wet seasons. The earliest plantations made in Ceylon were therefore made on low-lying land subject to floods. It was found that if the plants were well grown up, flooding did them no harm, whereas it was fatal to seedlings or very young plants. It would seem, therefore, that what the plants really require is a damp soil, and this has been borne out by local experience. The immense level area of the Amazon valley tends to prevent floods of any great depth, whereas in Ceylon the valleys are narrower, and the water may easily rise several feet. Land liable to frequent flooding should therefore be avoided.

"Chena land has been tried at Edangoda, but the result has been unsatisfactory; sandy soil also has been found unfavourable to the growth of *Hevea*, and the tree also grows badly where exposed to much wind.

"It would appear therefore that the most suitable soil and situation for this tree is fairly flat land, at about sea level, with good alluvial soil, preferably jungle land, and not sandy. The land should not be subject to frequent floods or strong winds.

"The area of land in Ceylon suitable for profitable rubber cultivation is thus comparatively small, possibly not more than 10,000 acres, but, on the other hand, this cultivation need not interfere with that of cocoanuts.

"*Cultivation.—Hevea* forms a moderately tall tree, not very much branched. It begins to flower at about six years old, but for planting purposes the seed of more mature trees (12 or more years old) is preferable.

"About February, in Ceylon, the leaves mostly turn brown and drop off, and the flowers soon afterwards appear. They are followed by large woody fruits, each containing three seeds, which ripen in July and August. The fruits open explosively, usually in the hot part of the day, and scatter the seeds to some distance. The seed is very large, weighing about half an ounce. It has a hard seed coat, and the interior substance is very oily.

"The seed soon loses its power of germination, and ought to be sown within a week of its falling from the tree. If it has to be sent on a voyage of more than a week, it should be very carefully packed in charcoal. Even thus, however, the majority of the seeds soon die, and the only satisfactory way of sending seeds to distant countries is to plant them in soil in a Wardian case and allow them to grow on the way.

"The germination of the seed is very rapid, and a long tap root is soon produced. The seed should be sown about an inch deep in well prepared soil, in nurseries, or, if preferred, in bamboo pots or baskets. They should be kept shaded and watered, and when the young plants are from 18 inches to 24 inches high they may be planted out. Good results are also obtained by stumping, the plants being allowed to grow about 3 feet high, then taken up, and the main root cut across about a foot below the ground; but the method of planting out the smaller seedlings is perhaps preferable.

"The plant may also be propagated by cuttings. The method employed in the botanic gardens has usually been to take cuttings near the ends of the branches, but further back than any of the leaves. Each cutting is about a foot long, and as thick as a lead pencil, and is cut off at both ends by oblique cuts made just below leaf scars. The cuttings are planted in nurseries in wet earth. This method is somewhat precarious; sometimes nearly all the cuttings grow, at other times only a small proportion.

"The seedlings, stumps, or cuttings should be planted out during rainy weather in prepared places. Holes should be dug as in the case of cacao, and filled with good soil. A little manure will often be advantageous. The young plants require to be lightly shaded for a time until they are established, and probably for the first two or three years they will grow the better for a certain amount of shade, such as would be given by narrow belts of trees running through the plantation. These belts should be arranged to act as wind belts, as the *Hevea* is easily injured by wind. By the time the trees are about three years old they will have grown up to a height of about 25 feet or 30 feet and form their own shade.

"Various distances apart have been tried in planting *Hevea*. The younger plantation at Henaratgoda Garden has the trees planted 12 feet apart. Their average girth is now about 30 inches, and they require thinning. It will not do, however, to conclude from this, as is sometimes done, that the trees should be originally planted more than 12 feet apart. On the contrary, the best results have been obtained by planting 8 or 10 feet apart each way. The

trees thus form their own shade and keep down weeds, and a process of natural selection of the best trees goes on, and the more weakly and dwarfed trees may be gradually thinned out in subsequent years. Another advantage of close planting is that the trees grow up straight without forming many branches low down, and this very greatly facilitates tapping.

"Para rubber is a surface-feeding tree, and catch crops should not therefore be grown between the trees, which require all the nourishment that the soil can afford.

"The young plants are greedily eaten by cattle, deer, hares, and other animals, and require careful protection for about eighteen months, after which time they are generally tall enough to require but little further protection.

"Weeding is also required for the first year or two, but afterwards the trees form a dense shade, under which but few weeds grow.

"The comparatively superficial growth of the roots renders manuring easy, and it would probably be found advantageous in poor or sandy soils.

"*Rate of growth.*—The tree grows very rapidly in height. The original trees, planted at Henaratgoda in 1876, were about 30 feet high and 14 inches in girth two years later. In 1882 the largest tree was 50 feet high and 25 inches in girth at a yard from the ground. The girth of this largest tree was taken annually after this, with the following results: It was 30 inches in 1883, 36 in 1884, 43 in 1885, 49 in 1886, 53½ in 1887, 60 in 1888, 65 in 1889, 69¾ in 1890, 73 in 1891, and 79½ in 1893. The girth of the largest tree measured in Brazil by Mr. Cross was 82 inches.

"The measurements above given are those of the largest tree. More useful data for scientific and practical purposes are obtained by taking the mean girth of all the trees on a considerable area. This was done in January, 1897, on the plantation made at Henaratgoda in 1876. This now consists of 45 trees, about 30 feet apart. The girth was taken at the height of the eye, about 5 feet 6 inches above the grouud. The largest tree was 7 feet 5 inches, the smallest, 2 feet 1 inch in girth. The mean girth was 4 feet ⅓ inch.

"*Tapping.*—The yield of rubber from very young or slender trees is too small to make their tapping worth while, and it is best for many reasons to abstain from tapping a tree until it has reached a girth of 2 feet. In a large plantation the girth of the trees always varies between wide limits. A few trees may be fit to tap after the sixth year, and in every subsequent year more and more trees will reach the size necessary. In favourable localities the bulk of the trees should be in bearing before the end of the eleventh year. The results of the experiments hitherto made at Henaratgoda go to show that it is inadvisable, having regard to the future, to tap trees of less than two feet in girth, but it is still an open question whether the minimum size of tree for tapping should not be fixed even higher. This however would of course necessitate longer waiting for the return, as the mean rate of increase of girth in trees of this size is only about three inches per annum.

"The methods of tapping and of coagulation of the rubber employed by the native collectors in Brazil and elsewhere are rough, wasteful, and inefficient, and there is great room for improvement Experiments are being made at Henaratgoda to test methods of tapping and coagulation, and their results will form the subject of a subsequent circular. At present we shall only describe the method which has been employed for some years in the tappings carried on at Henaratgoda.

"The requisites for the work are a $\frac{3}{4}$-inch chisel, a wooden mallet, a number of clean cocoanut shells, each cut in two so as to form small basins, a knife, and a supply of clay and water with which to form the gutters around the trees.

"The tree is first carefully and lightly shaved with the knife from a height of about 6 feet down to the ground, so as to form a perfectly smooth surface. Only the outermost layers of the bark must be removed in this process, otherwise the tree will be injured. When the shaving is completed, the tree may be polished by hand, or carefully brushed. The great object in view is to obtain a smooth and clean surface, over which the milk can run easily, without becoming contaminated by small particles of bark or other rubbish, as the market value of rubber depends on its cleanliness.

"A clay gutter is next made round the tree about 6 inches above the ground, so arranged as to catch the milk which will trickle down the tree and empty it by two or more spouts into as many clean cocoanut shells placed below. Three shells are sufficient for a tree of 2 feet 6 inches in girth, but larger trees may require four or five. The gutter is made by rolling rather wet clay into a sausage form, between the hands, and then pressing it on to the bark, and forming the channel against the bark by aid of a wet finger. The gutter must not be allowed to dry before the tapping is begun, otherwise the rubber will be contaminated by particles of clay; neither must the gutter be so wet or irregular as to allow the rubber to be dirtied.

"Incisions may now be made in the bark with the mallet and chisel, commencing near the top of the cleaned portion. A V-shaped cut is made in two strokes. The object to be aimed at is to make these cuts to such a depth as just not to reach the wood. They should stop in the bark close to the cambium, as the vessels which contain the rubber occur only outside, but very close to the cambium. If the cambium is not injured the wound rapidly heals, but if the cut penetrates this layer, and enters the wood, the healing of the wound is much slower, and at the same time risk is run of introducing parasitic fungi into the wood, which may cause much damage. Injury to the wood also causes a check to the upward flow of sap, and thus to the growth of the tree. Considerable practice is required before the chisel can be habitually driven in to the exact depth necessary. In dealing with a number of trees it will be found most economical and satisfactory to keep separate coolies for each of the various operations required, as they all need much practice.

"As soon as the cut is made, the white and very sticky milk commences to flow. A second V-shaped incision should be made about a foot below the first, and others at similar distances down

to the gutter at the base of the tree. Another set of incisions may then be made parallel to the first, at about ten or twelve inches from them, and other vertical rows of cuts may be made if there be sufficient room for them. On a tree of 2 feet 6 inches in girth, four vertical rows of cuts may be made without serious injury.

"As each cut is made, the milk flowing from the cut above it should be guided downwards to it along the bark by means of a twig, otherwise the milk is liable to be wasted by dropping to the ground from projecting portions of the bark.

"The bulk of the milk, especially in large trees or trees which have not been recently tapped, ultimately flows into the cups at the base of the tree. These should be kept covered in such a way as to prevent dust or other rubbish falling into the milk. As soon as the milk ceases to flow into the cups, these are removed to a warm place, and in a few hours a cake of solid rubber can be removed from each, which should be kept in a dry place until it has become properly dry all through. The remainder of the milk dries upon the tree in the form of long strings, which are stripped off and rolled into balls. The whole of the rubber when dry is now ready for market. The most suitable times of the day and of the year for tapping are still the subject of experiment. The most satisfactory results have on the whole been obtained by tapping in the drier parts of the two monsoons, *i.e.*, from January to April, and in August and September. The tapping should be done on dry days, otherwise it is difficult to prevent dilution of the milk and to dry the rubber.

"The tappings may follow one another at intervals of a week for about four to eight weeks. The second tapping gives a much larger yield than the first, and the third and fourth tappings are usually very productive. In a series of experiments made during 1897 on trees of about 2 ft. mean girth, the average yield per tree of the successive weekly tappings was as follows :—

	oz.		oz.
First week	·73	Fourth week	·80
Second week	1·48	Fifth week...	·67
Third week	·97	Sixth week	·52

Total ... ... 5·17 oz.

"*Yield.*—The statements as to yield of rubber found in books of travel and popular articles are very unreliable, and experiments are being made to test the whole question of yield. The late Dr. Trimen commenced in 1888 to tap one of the original trees at Henaratgoda, then nearly twelve years old and 50½ inches in girth, a yard from the ground.

"It was tapped on seven days between January 25 and February 15, yielding 17¼ oz. of rubber, on six days between July 20 and August 29, yielding 7 oz., and on four days between December 6 and 20, yielding 4½ oz. ; a total of 1 lb. 12¾ oz. The same method was followed in alternate years, with results as shown below :—

1888	1 lb. 12¾ oz.	1894	3 lb. 3 oz.
1890	2 lb. 10 oz.	1896	3 lb. 0¼ oz.
1892	2 lb. 13 oz.		
		Total ...	13 lb. 7 oz.

"The average yield of this tree from the twelfth to the twenty-first year is thus almost 1½ lb. per annum. This result is very good, and if all the trees of the same age yielded as much rubber, the success of the cultivation would be assured. It should, however, be noted that the girth of this tree in 1888 was larger than the mean girth of the whole plantation, as mentioned above, in 1897, and that therefore this yield, if the tree tapped be accepted as a fair sample, represents rather the result to be expected after twenty years, by which time the average girth of the trees should be equal to the girth of this one at the time its tapping was commenced. The trees in question are about 30 feet apart, *i.e.*, 50 trees to the acre. These data thus indicate a yield of about 90 lb. of rubber per acre in the twentieth year, a result insufficient to make it worth the while of private planters to take up rubber cultivation.

"It seemed probable that better results might be obtained by tapping younger and smaller trees more closely planted, and experiments were therefore begun in 1896 on a younger plantation of trees at Henaratgoda. The mean girth in January, 1897, taken at 5 feet 6 inches from the ground, of 225 of these trees, was 2 feet 4½ inches. The figures already given for the average weekly yields represent the mean results of the tapping of 27 trees of a mean girth of 1 foot 10½ inches, six inches less than the mean girth of the whole plantation. From six consecutive weekly tappings of each, a mean yield of 5·17 oz. per tree was obtained. This represents a yield of 97 lb. per acre of 300 trees (12 feet apart). If the trees tapped had been of the same mean girth as the whole plantation, the yield would probably have been at the rate of about 120 lb. per acre. Further, only six tappings were made, and the trees, after a rest of a few months, would probably have stood three or four more tappings whose yield might have been at the rate of 30 or 40 lb. per acre.

"No record, unfortunately, was kept of the date when this plantation was made. It is probably twelve years old at least. The sandy soil at Henaratgoda is unfavourable for Para rubber, and in better soil the trees would probably reach this mean girth in ten years or even less. It would seem, therefore, that if this cultivation is taken up in favourable localities, a yield of about 120 to 140 lb. of rubber per acre may be expected after the tenth year. This estimate is, however, liable to modification by the results of experiments which are still in progress.

"*Cost of opening Plantations.*—The following estimate of the first year's cost of opening a plantation of 300 acres of forest land with rubber was prepared by Mr. F. Lewis, Assistant Conservator of Forests, Colombo :—

	Rs.
Felling and clearing at Rs. 12 per acre	3,600
Lining, 10 ft. by 10 ft., at Rs. 2 per acre	600
Holing, at 75 holes per cooly at 40 cents.	697
Filling and planting and carrying plants from their nursery to holes, 300 per cooly at 40 cents.	175
Draining : 300 ft. of drains per acre at 1 cent. per foot run	900
Lines for coolies : 1 shed of 10 rooms of 12 ft. by 10 ft., mud walls, and battocalla roof, at Rs. 30 per room ...	300
Roads for inspection, 2 miles	160
Plant nursery, including watering	150
Carried forward	6,582

	Rs.
Brought forward	6,582
Weeding, at Re. 1 per acre per month	3,600
Cost of surveying lines round plantation, say	75
Contingencies, such as special work, bridges over streams, or supplying vacancies, &c.	250
Salary of assistant...	1,000
Tappal cooly	120
Tools...	300
Total ...	11,927

"This represents an average of Rs. 40 per acre. A return of Rs. 4,200 is estimated to be obtained by the sale of timber and firewood from the land cleared. This should suffice to erect the Assistant's bungalow and leave a small margin for contingencies.

"To this estimate private planters must add the cost of land and of seed (about Rs. 20 per 1,000). These items will probably bring up the total cost for the first year to at least Rs. 125 per acre. As a matter of fact, 300 acres is more than can be opened in one year, as the number of seeds required will be at least 160,000, which amounts to nearly two years' crop of the trees in the Botanic Gardens.

"For the second, third, and fourth years Mr. Lewis estimates the expenditure on weeding and supplying at Rs. 12, Rs. 8, and Rs. 5, respectively. Assuming that the expenditure in the years following is at the rate of Rs. 5 per acre, the cost of the plantation up to and including the tenth year, might work out as follows :—

	Rs.
Cost of land, 300 acres at Rs. 75	22,500
Cost of seed, say	3,600
First year's cost, as above	11,927
Weeding and supplying, second year	3,600
Do. third year	2,400
Do. fourth year	1,500
Do. fifth to tenth years, inclusive ...	9,000
Salary of assistant, second to tenth years, inclusive.. ...	9,000
Tappal cooly and tools, second to tenth years inclusive ...	1,250
Total	75,777

"Allowing interest at the rate of 7 per cent. on all money expended up to the end of the tenth year, the outlay upon the plantation will amount to at least Rs. 100,000, or Rs. 366·66 per acre.

"*Return.*—The value of Para rubber in the London market varies between two and four shillings per lb. according to the quality of the rubber and the state of the market. Of the rubber which has been collected in the Botanic Gardens and sent home for valuation, a large proportion has been valued at almost the highest market price then ruling, but a considerable proportion of the rubber is always of inferior quality, being mixed with particles of dirt. If we estimate the average value of the crop at 2*s.* per lb., and the yield in the tenth year at 100 lb. only per acre, the return in that year will be £10, or say Rs. 150 per

acre. The cost of harvesting should not be more than Rs. 50 per acre, including carriage to London. This leaves a margin of Rs. 100 per acre, representing a return of 27 per cent. upon the original outlay; if 12 per cent. be allowed for contingencies and the usual vicissitudes of a tropical cultivation, there remains still a prospect of a good return on the capital expended."

Para Rubber in India.

The climate of Bengal, where there is a distinct cold season, was soon found to be unsuitable for the cultivation of *Hevea brasiliensis*. After experimental efforts in other parts of India it was ultimately decided to establish rubber plantations at Mergui in Lower Burma, and Nilambur in Southern India. In accordance with the arrangement with the Government of India a first lot of plants propagated at Ceylon was despatched to Mergui in 1878. These consisted of 500 rooted cuttings. In 1887 there was sent a further consignment of plants and seeds. To Nilambur from 1878 to 1887 rooted cuttings and stumps were forwarded, as well as several lots of seeds. Of the latter 300 were sent in 1885. Further in 1880, two plants were sent to the First Prince of Travancore; in 1881 a Wardian case with 28 plants was forwarded to the Andaman Islands, and in 1888 about 3,000 seeds were sent to the Commissioner of Agriculture at Nagpur in the Central Provinces. There are now numerous trees both in Burma and Malabar producing regular supplies of seed. The introduction of *Hevea brasiliensis* trees into India has therefore been successfully accomplished.

In a letter received from the India Office, dated the 24th September, 1888, the following memorandum was enclosed containing an account of the result of the experimental cultivation of *Hevea brasiliensis* in Burma.

Note on the cultivation of *Hevea brasiliensis* in the Tenasserim Forest Circle, by Colonel W. J. Seaton, Conservator of Forests, dated 24th April, 1888.

Early Experiments.—Experiments on a small scale were commenced at Mergui in 1877, with eight seedlings, the survivors of a small batch received from Dr. King, Superintendent of the Royal Botanical Gardens, Calcutta.

They were successfully set out in the Forest Office compound at Mergui, and although on a low hill, a not very desirable site, yet their growth was for some time satisfactory.

In 1879, a large number of *Hevea* plants, believed to be well-rooted cuttings, were forwarded by Dr. Thwaites, Director of the Royal Botanical Gardens, Ceylon, and although in the charge of a subordinate who had been sent to Ceylon for special instructions, only 178 survived the voyage. These were set out in the plantation area selected, about $1\frac{3}{4}$ mile inland from Mergui, on somewhat low ground drained by the sources of the Boke Chaung, a small tidal creek.

Only 64 of the healthiest plants survived the planting operation, and of these again casualties continued to take place yearly, owing chiefly to attacks of white ants, until the number was

reduced to 50 in 1886, since when there have been no further casualties. The following were the sizes of ten of the largest trees of 1879 on 29th March, 1888 :—

No.	Height in feet.	Girth in inches at 2 feet from ground.	—
1	39	29½	Forked into two branches 4 feet from ground.
2	43½	37	Clean bole of 9 feet.
3	40	38	" " 8 "
4	34½	40½	" " 12 "
5	36½	39½	Forked at 3 feet from ground.
6	38½	27½	Clean bole of 8 feet.
7	36¾	31	" " 10 "
8	30	18	" " 6 "
9	31	27	" " 6 "
10	21½	18½	" " 8 "

Propagation with cuttings.—In the rains of 1879, 24 cuttings from the young trees in the Forest Office compound were set out in the plantation, but the experiment proved unsuccessful.

Subsequent attempts made from time to time met with no better success, the cuttings generally dying off during the second year.

Propagation with seed.—In 1884, a few of the older trees having commenced to seed, experiments were made, with the result that 51 seedlings were successfully raised.

These, however, when transplanted into the main plantation, were speedily reduced in number to 28 by attacks of white ants and the browsing off of the young shoots by deer.

The following year a large quantity of seed was procured from the 50 older trees, but, not being sown immediately after collection, a great portion of it failed to germinate, and only 121 seedlings were raised.

In the rains of 1886 better results were obtained by the timely sowing of the seed obtained from the older trees, and by the part removal of the husk enclosing the seed. As many as 7,030 seedlings were raised, germination occupying three to four days.

Experiments were continued in 1887, and 8,430 additional seedlings obtained.

From Ceylon 54 seeds were received in October, 1887, of which only 31 were fit to sow, but all failed to germinate.

Stock on hand at end of March, 1888.—The stock of trees and plants in the plantation and nurseries was as follows at the end of March :—

Trees set out in 1879		50
Seedlings of 1884 to 1886 set out in the main plantation at 20′ × 10′		2,752
In the nurseries ready for transplanting and distribution	of 1886	3,609
	of 1887	8,430
Grand total		14,841

General remarks.—The 50 older trees appear to be in perfect health, with evidence of such vigour as to leave no doubt that they are fully established, and have outgrown all danger from attacks of white ants.

They yield an abundant supply of seed, some of which, if allowed to fall, occasionally germinate under the trees.

The flowering takes place generally in January, in the cool season. The fruit forms in March and April, and ripens in July and August, about the middle of the rainy season.

It will be seen that the propagation of the *Hevea brasiliensis* in this part of Burma is now quite independent of external assistance, and that its acclimatization has been successfully demonstrated.

It now only remains to subject the larger trees to periodical tapping to ascertain the yield in caoutchouc, after which the question will have to be determined as to the precise area which it may be advisable to plant up at Mergui and other suitable localities with this valuable tree.

The following further correspondence affords information respecting the experimental tapping of *Hevea* trees in Tenasserim:

INDIA OFFICE TO ROYAL GARDENS, KEW.

India Office, Whitehall, S.W.,
26th April, 1889.

SIR,

IN continuation of Mr. Walpole's letter of the 24th September last (R. S. & C. 1269/88), I am directed by the Secretary of State for India in Council to forward for your information a copy of a letter received from the Government of India, together with its enclosures, reporting the results obtained from tapping *Hevea brasiliensis* trees near Mergui, in Tenasserim.

The specimens of caoutchouc referred to in the enclosures have been forwarded to you separately by parcels post.

I am, &c.,
(Signed) C. E. BERNARD,
Secretary,
Revenue, Statistics, and Commerce
Department.

The Director,
Royal Gardens, Kew.

MEMORANDUM from Colonel W. J. Seaton, Conservator of Forests, Tenasserim Circle, to the Chief Secretary to the Chief Commissioner of Burma, dated 28th January, 1889.

Referring to my letter, No. 330–24, dated 6th October, 1888, I have the honour to advise the despatch by parcel post of a package containing the following quantities of caoutchouc, which have been obtained in the tapping of the *Hevea brasiliensis* trees in the plantation near Mergui :—

Collected in July, 1888.

(1.) From 5 trees on the west bank of the Bôkchaungale 5 oz.

Collected in November, 1888.

(2.) From 37 trees on the east side of the Bôkchaungale 9 oz.
(3.) From 5 trees on the west bank ... ... 3 oz.

2. The tapping experiment was first undertaken in July, under the impression that the flow of milk would be more abundant during the rainy season.

Small bamboo pots were, in the first instance, affixed to the trees by means of well-wrought potter's clay, and above them small pieces of tin were also placed in such a position as to protect them from the rain; but, as the clay yielded to the rain and fell to the ground, tapping had to be undertaken at intervals between the showers, the bamboo pots being affixed by sharpening the upper end and forcing them into the bark in the manner followed by the "Thitsi" collectors. In order to obtain the largest quantity of milk in the shortest time possible, numerous incisions were made on the trees. The incisions were made in an upward direction and converging as required.

The quantity of milk collected was so small in the intervals between the showers that it was deemed necessary to limit the experiment finally to five of the larger trees on the west bank of the Bôkchaungale, which flows through the plantation. The milk was found to flow much more freely from these trees, although not much larger than the trees first experimented upon. They have, however, thicker bark, and it was observed that the exudation of milk was greatest near the ground, where the bark was thickest, while at a height of 6 or 7 feet it was almost *nil.*

Owing to continued wet weather, it was found necessary to dry the milk over a fire and keep it subsequently in a warm place near the fire for about three weeks.

3. The experiment was renewed between 22nd and 26th November, when the rains had fully ceased, 42 trees being operated on, *viz.*, 5 to the west and 37 to the east of the Bôkchaungale.

The method of tapping was the same as that followed previously: but the yield from each incision being small (less in fact than was the case in the rains), the several trees were tapped to their utmost extent, and, by constantly collecting the milk before it had time to dry, the quantity now forwarded was obtained, *viz.*, 3 oz. from the 5 trees to the west, and 9 oz. from the 37 trees to the east, of the Bôkchaungale.

4. I append a statement exhibiting the girths of the *Hevea* trees tapped between the 22nd and 26th November, 1888, and the number of incisions made on each :—

—	Average Girth.		Average number of Incisions.
	Ft.	ins.	
5 trees west of stream	3	1	22
37 trees east of stream	2	7	12

Mr. J. W. Oliver, Deputy Conservator of Forests in Charge of Tenasserim Circle, supplied the following information explaining the method of collecting and drying the rubber :—

The milk collected from the trees west of the stream was poured into a deal-wood box, and the milk from the trees east of the stream was poured into bamboo split into halves lengthwise. The milk was put out in the open air in the sun during the morning, placed in the shade during the heat of the day, and again put out in the open in the afternoon at about three o'clock. As soon as the milk became firm, more milk was poured over it. The milk coagulated so quickly on the trees that about 30 per cent. of the milk was collected in the shape of *sernamby*. Instead of keeping them separate, these odd pieces were placed in the milk in order to secure the rubber in one mass. These are the darker pieces of rubber which may be seen in the largest piece of rubber. I do not think that they affect the quality of the rubber in any way, the odd pieces themselves being drier, and so perhaps of a better quality than the surrounding rubber.

Royal Gardens, Kew, to India Office.

Royal Gardens, Kew,
June 4, 1889.

Sir,

I am desired by Mr. Thiselton-Dyer to acknowledge the receipt of your letter of the 26th April last (R. S. & C. 614) forwarding a copy of a letter received from the Government of India with enclosure reporting the results obtained from tapping trees of *Hevea brasiliensis* near Mergui in Tenasserim.

2. The specimens of caoutchouc referred to were duly received by parcels post, and they were subsequently submitted for valuation and report, through S. W. Silver, Esq., F.L.S., to the India Rubber, Gutta Percha and Telegraph Works Company, Limited, at Silvertown.

3. I enclose herewith a copy of the valuation and report received respecting them. On the whole this report is favourable. The small quantity of rubber available (in no case exceeding a few ounces in weight) rendered its manipulation somewhat difficult; but bearing this fact in mind the result as shown in the samples of prepared rubber sent in a separate cover is very encouraging.

4. It will be noticed that the best quality, valued at 2*s.* 3*d.* per pound, is nearly equal to the best South American rubber. This was labelled "Sernamby" and was formed by milk which coagulated immediately on the trees in the dry season.

5. The rubber (marked No. 3) obtained from trees during the rainy season was dried over a fire. The quality of this appears to be better than either No. 1 or No. 2, and it approaches very near to No. 4. Except as regards the difficulty of coagulating the rubber there appears from these experiments to be little difference between the specimens collected during the rainy season and those collected "when the rains had fully ceased."

6. All the trees tapped were young and few were more than 12 inches in diameter. Mr. Thiselton-Dyer is of opinion that it is very desirable that these interesting experiments should be

continued if there are sufficient trees available. If during the dry season the milk is found to coagulate readily on the trees, this method might be provisionally adopted with the view of testing on a larger scale its suitability for general use in India. Where, however, the milk does not coagulate readily, it might be advisable to try the cautious application of dry heat in the most convenient manner locally available. Mere sun heat, especially during the rainy season, does not appear to produce good rubber.

7. In South America the milk of *Hevea brasiliensis* is collected generally at the beginning of the dry season. When the quantity collected is large it is necessary, in order to prevent decomposition, to obtain the caoutchouc in a solid mass as soon as possible. The best Para rubber is prepared by dipping a wooden paddle in the milk and holding it in the thick hot smoke from burning wood and palm nuts. When the first layer is dry the paddle is dipped again and the process repeated until a thick solid mass of caoutchouc is obtained. A slit is made down one side, the rubber is peeled off the paddle and hung up to dry.

I have, &c.,

J. A. Godley, Esq., C.B., (Signed) D. MORRIS.
India Office, Whitehall, S.W.

[Enclosure.]

REPORT from India Rubber, Gutta Percha and Telegraph Works Company, Limited.

Silvertown, May 30, 1889.

The four samples of *Hevea* rubber received from Kew have been treated with sulphur in the same way as that adopted in the case of the better kinds of Brazilian rubber. Allowance must be made for the smallness of the quantity experimented upon.

Eight samples sent herewith, four each, "washed" and "cured."

No. 1. Has the appearance of that imported some 12 months since, and known as Rio rubber; is soft, and would decompose if exposed to the necessary heat, after washing, losing 12 per cent. in that process; its commercial value 1*s.* 11*d.* to 2*s.*

No. 2. Slightly firmer; in other respects the same as No. 1.

No. 3. Percentage of loss somewhat less, and therefore of a trifling increased value.

No. 4. Found to be stronger and firmer; not so likely to decompose when drying; worth 2*s.* 3*d.*; owing to the scrappy nature the loss is greater than it otherwise would be.

In Southern India the results of the cultivation of Para rubber trees have so far not been satisfactory. In 1888 Mr. Lawson was asked by the Government to supply a short resumé of the success which had attended the cultivation in the Madras Presidency. He replied as follows:

"There are three young trees of *Hevea brasiliensis* in the Barliyár Gardens. They are about 20 feet in height, and have stems of about 18 inches diameter at the base. . . . They grow vigorously and they have flowered for the first time this spring, but so far I have been unable to extract rubber from them in any quantity."

At Nilambur the rubber trees (Ceara and *Hevea*) were planted amongst teak trees. In the Administration Report for 1884–85 it was stated "the growth of the rubbers on the whole continued good though Mr. Hadfield doubted whether they would yield much revenue as there was little milk in the seven years old trees." Again: "One pound of rubber was obtained from 80 of the largest trees in 1886–87 but no tapping was done subsequently."

No distinction appears to have been made in these Reports between the *Hevea* and Ceara rubbers. It is possible that the failure noted applies more particularly to the latter trees.

The latest information available on the subject is contained in the Report of the Nilambur Teak Plantations, 1895 (Appendix C., p. 69). The following remarks (quoted from Commercial Circular, No. 8 of 1897, issued by the Reporter on Economic Products to the Government of India) appear under Exotic Plantations—Rubber :—

"3. *Working.* The rubber is quite out of place in the middle of a teak plantation, even should it prove itself of any commercial value. The soil occupied is some of the most valuable in the plantations. Experiments are now being conducted in tapping the rubber, and, as far as they have gone, show little prospect of any material revenue being realised. The biggest trees are now nearly 20 years old, and each covers the space required for two teak trees of the same age. The yield appears to be from 4 to 6 oz. of rubber which production may perhaps be continued for five or six years (even this is very doubtful), and the result expressed in current coin would compare very unfavourably with the value of two teak trees of the same age.

"Probably the most paying thing to do would be to fell this area in 1895, clean and to plant it up with teak. In order, however, that the success or failure of the rubber growing may be proved, it is proposed to clean and fell at the end of the first rotation in 1900, when very few saplings of small size will be available, and plant up the whole area with teak in 1901. This compartment will then work into the working circle."

In a Note on the Working Plan for the Nilambur Valley Teak Plantation the Inspector-General of Forests in India, Mr. B. Ribbentrop (*Indian Forester*, 1898, p. 168) discusses the suggestions for cutting out the rubber trees as follows :—

"It would appear that the experiments carried out with the introduction of rubber-yielding trees have so far been unsuccessful, but I feel nevertheless disinclined to agree in the proposal that the experiments of making the Nilambur Basin an important centre of rubber supply should be discontinued. . . . To me it seems that the Nilambur Basin is eminently adapted for the growth of rubber-yielding plants, and the facility of export renders the prospect of a trade in a product which can bear a land transport of hundreds of miles particularly attractive. The demand for rubber, and its price, are constantly increasing, and I would strongly advise that experiments should be continued till the most suitable rubber-yielding tree is found, which will grow in localities not required for the extension of the teak plantation."

Para Rubber in the Straits Settlements.

Plants of Para rubber were forwarded direct from Kew to Singapore in 1876. In 1877 Mr. Murton reported : "Our climate is evidently suited for the growth of *Hevea*, judging by the progress the plants sent last year have made." Some of these plants were afterwards introduced to Perak, where, in 1879, Mr. (now Sir Hugh) Low reported : "The Heveas are 12 to 14 feet high. They take to the country immensely."

Kew possesses very little information in regard to the number and character of the Para rubber trees now existing at Singapore. Mr. Ridley, Director of the Gardens and Forest Department, was, however, good enough to forward photographs, in May last, of a rubber plantation in the Botanic Gardens, showing a grove of trees of different ages and sizes. One of these had been tapped at nine years old, and had yielded two pounds of rubber.

An interesting account of the original trees planted at Kuala Kangsar by Sir Hugh Low was lately given by Mr. R. Derry in *Perak Museum Notes*, Vol. II., pp. 101–102. They are yielding seeds freely (25,000 last year), and are considered at present of more value as seed bearers than as rubber producers. The following letter has been received from Mr. Derry :—

Curator, Government Gardens and Plantations, Taiping, Perak, to Royal Gardens, Kew.

Government Plantations Office, Taiping,
October 6, 1897.

Dear Sir,

I am now able to reply to your letter, dated December 14, 1896, with reference to Para rubber trees planted by Sir Hugh Low at Kuala Kangsar, Perak.

It is quite a mistake to suppose that these yield no rubber. I have collected over 1 cwt., and find the trees run quite freely. From a few trees I have collected 5 lbs., each and only stopped for fear of taking too much.

I notice in the extract from Sir Hugh Low's letter (which you sent me) that the trees had previously been tapped by Dyaks unsuccessfully. As you are aware, Para rubber does not exude for some days after the incisions have been made, and Dyaks, who are familiar with such rubbers as *Alstonia*, *Ficus*, *Willughbeia*, &c., no doubt concluded that as the trees did not run at once when tapped there was not any rubber—hence the mistake.

I am now sending samples home for valuation.

I am, &c.,
(Signed) R. Derry.

The Director,
Royal Gardens, Kew.

The following further particulars, communicated by Mr. Derry, are taken from the *Perak Government Gazette* for April 8, 1898 :—

Para Rubber (*Hevea brasiliensis*).

Many trees have been tapped, and a report on the work submitted. The rubber obtained is not yet sufficiently smoked for sending home, but samples have been valued in Mincing Lane at 2*s*. 8*d*. and 3*s*. per pound, and considered equal to Brazilian produced rubber, and also worth 1*s*. per pound more than that usually sent home from the Straits.

There has been a large demand for seeds, and about 35,000 have been supplied. How far this industry is deserving attention may be inferred from the following moderate estimate :—

(Planted 14 feet × 14 feet = 225 trees to the acre.)

Age.	Yield per tree.	Yield per acre, *i.e.*, one tree × 225.	Gross value per acre, estimated at 2*s*. per pound.
Years.	Ounces.	Pounds.	£ *s*. *d*.
6	10	140½	14 10 0
7	18	250	25 0 0
8	26	365	36 15 0
9	34	478	47 13 0
10	42	590½	59 1 0

The importance of close planting is not generally realised. Planted at 14 feet × 14 feet, against 25 feet × 25 feet, would possibly result in a difference of one year in six in favour of close planting. I am of opinion that, planted 14 feet × 14 feet, trees could be tapped in the fifth year, if not earlier. Para rubber is a remarkably adaptable tree, growing in swampy land or dry, high ground without, so far as I have tested, any difference in the yield of rubber.

The following extracts are taken from Notes on Rubber Growing in Perak by Mr. L. Wray, Curator and State Geologist, Perak, dated 4th December, 1897 :—

In 1887 some seed was obtained from the Kuala Kangsar trees and planted in the Museum grounds, Taiping. The soil is very bad, the land having all been mined over, but still the trees have grown well and have attained, in the ten years which have elapsed since they were planted, a considerable size.

The tree has also been planted at Parit Buntar, where it grows well. It is in the garden of the District Magistrate, and close to the river. The land is occasionally flooded by the river, and in the ordinary way at high tide the river is only a foot or two below the level of the surface of the ground. The river is quite salt enough for the Nipa palm to grow well on its banks.

It has been planted at Sitiawan, also on low land near the sea; at Tapah, Batu Gajah in Kinta, and other places in the State, and in all it has grown well.

It may therefore be stated that it will thrive in any locality, from the *bakau* swamps to the foot-hills, and on any soil, from rich alluvial to old mine heaps.

So far I have not noticed that it has any enemies which do it serious injury. When large areas come to be planted up there may arise trouble with some pest, but at present there does not appear to be any indication of such a contingency.

Hitherto the trees have been planted singly, and, as might be expected, they have grown with short trunks and bushy tops. To be a success—that is, to yield large quantities of rubber—the tree must be planted so that it will run up and form a tall, straight, branchless trunk.

There is little to guide one on the subject, but from 15 to 20 feet apart would appear to be about the correct spacing. At

20 feet it might be necessary to plant something in between them to keep them from early branching, but this would not be necessary at 15 feet. In Larut, at an estate at Kampong Dew, they are being planted at 10 by 10 feet, that is 544 per acre. It is very close, but it is the intention, I am informed by Mr. Waddell Boyd, the manager, to thin them out later on to 20 by 20 feet or 108 per acre, tapping the intermediate trees—that is, those which are ultimately to be thinned out—as early as possible and as severely as they will stand, while the others are allowed to grow to a large size before tapping.

With a view to giving some data respecting the growth of the trees, I have measured thirteen of those in the Museum grounds. These trees, it is to be remembered, are ten years old, and are planted on mined land of the poorest quality. For these 13 trees the mean height is 74 feet, and the mean girth at 3 feet from the ground is 4 feet 2 inches. This gives a mean annual growth in height of 7 feet 3 inches, in circumference of 5 inches, and in diameter of 1·6 inch.

The trees are very prolific seed bearers. Those in the Museum grounds have this year yielded nearly 14,000 seeds—or, to speak more correctly, that number have been collected. Most of the trees are planted by the side of a large ditch, and all the seeds which fall into it are at once carried away, as they are very light and float on the water. The seeds have been distributed, 3,000 going to the Jebong Estate, and 11,000 to the Sam Sing Estate.

At 15 by 15 feet 14,000 seeds would be enough to plant 72½ acres of land. Where the land is ready it is certainly an advantage to plant the seed at stake, but where this cannot be done not much loss would follow planting in nurseries and then transplanting. The thing to avoid in this method is the production of double stems near the ground, caused by the original shoot dying out or being broken off.

It has recently been proved by Messrs. Curtis, Derry, and others that these trees will yield at least one pound per tree per year of clean rubber. Taking the value of the rubber at 2*s.* per pound only, we get for an acre of land planted at 20 by 20 feet, an annual crop worth £10 16*s.*, and if planted at 15 by 15 feet worth £19 6*s.* This should begin, as far as is now known, at about the sixth or seventh year, and by the 12th year should have increased to double the amounts given.

A sample of rubber obtained from a tree cultivated in the Botanic Garden, Penang, and recently forwarded to Kew by Mr. C. Curtis, has been submitted to Messrs. Hecht, Levis & Kahn, 21, Mincing Lane, E.C., who report upon it as follows :—

"Worth to-day (31/8/98) 3*s.* 3*d.* per lb. ; beautiful rubber, very well cured."

It may be mentioned that Fine Para rubber is now selling at about 4*s.* 4*d.* per pound. It would be interesting to learn why this "beautiful rubber" from Penang should be valued at more than a shilling per pound less than Amazonian rubber. One explanation is that *Hevea* rubber cured in any other way than by the smoke of palm nuts is intrinsically not so good as Fine Para. This is evidently not the whole story. It is possible there is a

certain amount of prejudice existing against *Hevea* rubber in any other form than that in which it has always been received in this country. In any case it is desirable to institute a comparative chemical investigation of the value of Brazilian rubber as against that obtained from cultivated trees. So far it would appear that no *Hevea* rubber obtained from cultivated trees has reached the highest prices attained by Amazon rubber.

Zanzibar.

In the "Shamba," the Journal of Agriculture for Zanzibar (October, 1897, p. 2), issued by Mr. R. N. Lyne, F.L.S., the Director of Agriculture, the following interesting note appears respecting a fine tree of *Hevea brasiliensis* growing at Mbweni. This, originally received from Kew, was planted in the Botanical Garden established by Sir John Kirk when he was Consul-General at Zanzibar (see *Kew Bulletin*, 1896, pp. 80–86) :—

"The cultivation of rubber is beginning to occupy attention here now. At Mbweni, there is a Para rubber tree 50 feet in height and over 6 feet in girth. It is a beautiful tree, clean and straight in the trunk, with not a branch to interrupt its tapering symmetry till the crown is reached. It is now flowering. We believe that this tree has not been tapped, but a casual stab in passing induced a flow of milk which suggested a good reserve. This tree is growing in a spot which by no means corresponds to the conditions of its natural habitat in Brazil which are low and alluvial. At Mbweni, the Para rubber tree is found on a porous sandy ridge within 100 yards or so of the sea cliff. And yet it has grown on this apparently uncongenial locality with the greatest vigour. In the richer and damper soils, it ought to thrive as in its native country."

Mozambique.

In the report on the trade of Portuguese East Africa for the year 1889 (*F.O.* Annual Series, 1890, No. 742), forwarded by Sir H. H. Johnston, Mr. Vice-Consul Ross at Quilimane records the existence of trees of *Hevea brasiliensis* as follows (p. 10) :—"In a private garden on the bank of the Chinde River, I was shown half-a-dozen very healthy Para rubber trees a year old, and some 15 feet high. They had fruited well, and the owner had sown in the neighbourhood most of the seeds they had borne."

West Africa.

Gambia.—In the report on the Botanic Station at the Gambia for 1897, the Curator reported (*Kew Bulletin*, 1898, p. 41) : "a few plants of this are at the Station, but they do not appear to be growing well, owing to the long dry season."

Sierra Leone.—In the First Annual Report on the Botanic Station at Freetown, Mr. Willey, the late Curator, states : "Some plants of the Para rubber, the premier rubber of the world, are growing here, but they are too small yet to express an opinion as to their ultimate success. They will be reported on later."

Gold Coast.—In the Report on the Botanic Station at Aburi for 1894 the Curator states, "rubber plants, especially Para rubber, are making good progress. Some of the trees only 18 months growth are 10 feet high and have stems 3 inches in diameter."

Lagos.—In Mr. Millen's Report on the Botanic Station for the quarter ending 30th September, 1895, mention is made of *Hevea spruceana* but not of *H. brasiliensis.* The former is described as having done "fairly well." In the Report for the year 1897 seeds of *Hevea brasiliensis* are acknowledged as having been received from Kew.

Para rubber trees have been introduced to French and German possessions in West Africa. They are described as having done well in some localities in the Cameroons, and according to the *Tropenpflanzer* rubber has already been obtained from them.

West Indies.

Jamaica.—Seeding trees of Para rubber have existed at the Castleton Gardens, Jamaica, since 1882. In the *Bulletin* of the Botanical Department, 1894, p. 104, Mr. Fawcett, the Director of Public Gardens and Plantations, states :—

"There are young trees at both the Castleton and Hope Gardens, but they have not yet yielded any rubber. The bark is about ½ inch thick, and the lactiferous vessels lie in the inner half of the bark. From examination made in the Gardens, it would appear that this tree will succeed only in Jamaica grown as a forest tree with its bark shaded, and its roots in a soil which is constantly wet. It is quite possible that these conditions are more important than the rainfall, and that the tree might be grown in the swamps along the South Coast."

Dominica.—In the Report on the Botanic Station at Dominica for 1896 it is stated : "We have now all the best kinds of rubber trees, viz., *Hevea*, *Castilloa*, *Ficus*, *Manihot*, and *Kickxia* . . . The plants of *Hevea* and *Kickxia* are still small."

St. Vincent.—According to the Report on the Botanic Station at St. Vincent for the quarter ending 30th of June, 1891, six plants of the Para rubber tree were planted out at the Station during that period. There is no record in later Reports of the success of this experiment. The Central America rubber tree (*Castilloa elastica*) is said to be doing very well in St. Vincent.

Grenada.—The Para rubber tree is recorded as under cultivation at the Botanic Station, Grenada, in a list published in September, 1893. In 1895 it was in flower and fruit.

Trinidad.—In the Annual Report for the year 1897 on the Royal Botanic Gardens at Trinidad, Mr. Hart, the Superintendent, states "the Heveas or the Brazilian and Demerara rubbers are trees of large size and do not bleed so freely as *Castilloa*, neither do they grow so quickly, but they have the advantage of being able to grow in places where *Castilloa* could not thrive. Trees of large size are present in the Garden and annually give us seed in limited quantities."

The following interesting particulars have lately been received respecting rubber obtained from these trees during this year :—

Superintendent, Botanical Department, Trinidad, to Royal Gardens, Kew.

Botanical Department, Trinidad,
June 22, 1898.

Sir,

I forward you a ball of *Hevea* rubber collected from our trees in the following manner :—The rough bark was first "spoke-

shaved" so as to obtain a clean surface without injuring the cambium. At the upper part of the surface thus exposed longitudinal slits were made some four or five inches long and sufficiently deep to reach to the xylem. Streams of latex then commenced to run down on the clean surface, which when partially dry were collected by rolling into a ball. Every night for eight successive nights, the latex started afresh and was collected in the morning. The quantity appears to be greater after rainfall. It came without fresh cutting.

Yours faithfully,

The Director, (Signed) J. H. HART.
Royal Gardens, Kew.

MESSRS. HECHT, LEVIS & KAHN TO ROYAL GARDENS, KEW.

21, Mincing Lane, London, E.C.,
July 12, 1898.

DEAR SIR,

IN reply to your favour of the 8th instant, which only reached us this morning, we have examined the ball of *Hevea* rubber from Trinidad which you sent us and find the quality excellent in every respect, clean, strong, and dry. This rubber would be readily saleable in this market and would at the present moment command a very high price, probably about 3*s.* to 3*s.* 2*d.* per lb., perhaps even a little more.

Yours faithfully,
(Signed) HECHT, LEVIS & KAHN.

BRITISH GUIANA.

Hevea brasiliensis does not appear to have taken well in this colony. According to Mr. Hemsley there are at least two species of *Hevea* native of British Guiana. *Hevea pauciflora*, Muell. Arg. (*H. spruceana*, Oliver, pro parte, in *Kew Report*, 1880, p. 37) has been collected by Jenman (Nos. 725 and 2450), and by im Thurn (No. 200) on the Mazaruni River. The other Guiana plant has recently been described as a new species and is *Hevea confusa*, Hemsley (*Hooker's Icones Plantarum*, vol. vi., pt. iii., t. 2574, figs. 1–3). This was collected by the Schomburgks and by Prestoe on the Mazaruni River, by Jenman on the Mazaruni (No. 621) and Essequebo Rivers (No. 1332), and is now under cultivation at the Trinidad Botanic Gardens (Hart, No. 3554).

A Report on "some of the Rubber-producing Plants of British Guiana, by the Government Botanist," was published at the "Royal Gazette" office, in Georgetown, in 1883. Later information on the same subject is included in a Report on "the Balata Industry of British Guiana," published in 1885.

The following brief account of the rubber-yielding plants of British Guiana appeared in the Appendix to the Report of the West India Royal Commission, 1897 (*Kew Bulletin*, Additional Series I., pp. 34–35):—

The most promising rubber tree is the "Hatie." This is found in the upper basin of the Essequebo and Mazaruni rivers, and probably yields some of the crude rubber sometimes received from that region. It is also found in some districts on the Pomeroon river. Mr. Jenman calculates that from a large tree

several pounds of rubber might be produced. The milk of a tree or trees known as "Touckpong," or "Cumakaballi," is sometimes mixed with balata milk, but it is not separately prepared. A specimen of rubber obtained by Mr. Jenman from a large twining plant known locally as "Macwarrieballi," and determined to be *Forsteronia gracilis*, was received at Kew in 1888. It was shown that if the plant from which this rubber was prepared existed in any quantity in the interior of the Colony, the collection of the rubber would be a very promising commercial undertaking (*Kew Bulletin*, 1888, pp. 69–71).

It is very desirable that all these rubber trees should be carefully and exhaustively investigated in order to find out their true value. It is probable that it may be found profitable to establish natural plantations in districts where the best rubber trees are already found. This could be done with little difficulty, and it offers the best means of immediately extending the area under rubber trees in different parts of the Colony. Where plants are plentiful it would only be necessary to clear away some of the other vegetation and allow the rubber trees more light and air, as well as thinning them out when too crowded. Where the conditions are favourable, and the plants only sparsely found, wild seedlings might be transplanted or fresh seeds "dibbled in" at intervals to fill the vacant places. The cost of this plan would not be considerable, as the trees would require little attention after they were well started.

DCXXVI.—MISCELLANEOUS NOTES.

The Secretary of State for India in Council has appointed, at the nomination of Kew, Mr. CHARLES ALFRED BARBER, B.A., F.L.S., Professor of Botany, Indian Civil Engineering College (Forestry Branch), and (1891–5) Superintendent of the Agricultural Department of Agriculture of the Leeward Islands (*Kew Bulletin*, 1891, p. 245), to be Government Botanist, Madras, in succession to Mr. M. A. Lawson, who died 1896 (*Kew Bulletin*, 1896, p. 185).

MR. ROBERT EVANS GRESSON, a member of the gardening staff of the Royal Gardens, has been engaged as head gardener by Archibald Findlay, Esq., for his garden in Durban, Natal.

Foreign Estimation of Kew.—The Paris Journal *L'Eclair* gives the following account in its issue for August 17th of the organisation of botanical work in British Colonies and of its relation to Kew :—

"Les Anglais sont arrivés, en ce qui touche la culture et la propagation des plantes tropicales, à créer une organisation excellente donnant des résultats parfaits.

"Ils ont établi dans chacune de leurs colonies des établissements spéciaux, dont le but est d'utiliser les ressources de la

végétation exotique. Ces établissements sont classés en trois groupes bien distincts :

"1° Les départements botaniques qui sont un groupement d'établissements et de jardins sous la direction d'un seul fonctionnaire. La surface totale d'un département botanique varie entre 100 et 500 acres, et sa dépense annuelle entre 75,000 et 150,000 francs. Des départements botaniques existent à Calcutta, à Madras, à Ceylan, aux Straits Settlements, à Maurice, en Australie et à la Jamaïque.

"2° Les jardins botaniques, institutions à peu près similaires à celles des établissements botaniques, mais occupant une surface moindre excédant rarement 50 acres, et nécessitant une dépense annuelle de 25 à 75,000 francs. Ces jardins existent à Hong-Kong, dans l'île de la Trinité, dans la Guyane et dans les provinces nord-ouest de l'Inde.

"3° Les stations botaniques qui ne sont que des diminutifs des jardins botaniques, et dont le rôle principal est de maintenir en parfait état les pépinières destinées à fournir des plantes économiques en vue de la distribution aux colons. Des stations botaniques existent à Saint-Vincent, Sainte-Lucie, Dominique, Monserrat, Saint-Kitts-Nevis, la Lagos, la Gold-Coast, la Gambie et Sierra-Leone.

"Ces différents établissements ne coûtent rien au gouvernement anglais ; chaque colonie en supportant les frais. Ils sont eux aussi *self supporting*. Dans quelques colonies, cependant, telles que Natal, les jardins botaniques sont dirigés par un comité scientifique, subventionné par le gouvernement, qui voit le plus souvent ses dépenses couvertes par la vente des plants dans la colonie.

"Mais ces divers établissements ne sont que la première partie de l'organisation ; la seconde partie est le magnifique jardin de Kew, situé aux environs de Londres. Sans le jardin de Kew (Royal Botanic Garden, Kew), les multiples jardins coloniaux situés dans les colonies anglaises ressembleraient fort à un immense corps sans cerveau, et leurs efforts, si énergiques fussent-ils, seraient souvent menacés de demeurer stériles.

"Kew est en perpétuelle correspondance avec eux, et se tient con stamment au courant de leurs tentatives. Il reçoit directement les plants et les graines recueillis par chacun d'eux ; une fois qu'il les possède, il essaie de les utiliser, puis de les expédier dans une autre colonie. Kew sert ainsi d'intermédiaire entre les diverses possessions anglaises pour tout ce qui concerne les cultures coloniales ; il crée entre elles l'échange des graines et des plants —point essentiel,—il reproduit dans des serres spécialement aménagées, soit au moyen de semis, soit au moyen de boutures, des végétaux susceptibles d'être utilement introduits dans certaines colonies, ou des variétés végétales paraissant plus avantageuses que celles qui y sont déjà cultivées. En somme, ce jardin de Kew, grâce à ses essais répétés, grâce à ses sélections savantes, améliore perpétuellement la culture coloniale pratiquée dans le vaste empire colonial de l'Angleterre. Il a été toujours à même d'approvisionner le colon anglais de plantes industrielles très avantageuses. C'est de Kew que sont partis les quinquinas ayant fait la fortune des colonies britanniques ; c'est de Kew que sont partis les Hevea (caoutchouc du Para) que l'on cultive avec succès aux Indes.

"Ce jardin rend encore à la cause coloniale anglaise un autre service—service qui n'est pas le moindre à mon humble avis—en formant des jardiniers en vue de la culture des plantes tropicales. Il est, selon une heureuse expression de quelqu' un ayant suivi son enseignement, une université de jardinage, dont les élèves deviennent rapidement aptes à prendre la direction d'un jardin botanique ou d'une plantation.

"Ce jardin de Kew est largement doté et fort encouragé par le gouvernement anglais qui en apprécie hautement les services. C'est ainsi qu'au Parlement anglais, en avril 1897, M. Chamberlain ne craignait pas de faire à son sujet la déclaration suivante : 'Comme secrétaire des colonies, j'ai été et suis en relations constantes avec Kew en ce qui concerne la culture de toute espèce de plantes, et je n'hésite pas à dire que quelques-uns des plus grands perfectionnements apportés dans certaines colonies sont dus presque entièrement aux avis et à l'assistance de Kew.'

"J'ai tenu à visiter Kew-Gardens et à me rendre compte un peu de son organisation. Dans cette visite, j'étais accompagné par mon excellent confrère Milhe-Poutingon, directeur de la *Revue des Cultures Coloniales*. Nous nous proposions l'un et l'autre de passer une journée intéressante, et notre espoir n'a pas été déçu.

"Après une heure environ de chemin de fer ou de Tamise on arrive à Kew Gardens. C'est un ancien domaine de la Couronne, qui a fort belle allure. Sa surface est de 135 hectares. Son aspect est celui d'un beau parc aux grandes allées ombragées et bordées de massifs de fleurs d'une variété infinie. Ce parc abrite des serres innombrables ouvertes au public, et contenant toutes les variétés connues de la fleur du monde entier.

"Les serres économiques et coloniales occupent un endroit spécial, et sont rigoureusement interdites au public. Heureusement que cette sévère consigne ne nous fut pas appliquée.

"Tout au contraire, le directeur de Kew, M. Thiselton-Dyer, qui nous fit un accueil aussi charmant que possible, désira que non seulement les serres économiques et coloniales nous fussent ouvertes, mais encore qu'un jardinier parlant le français nous les fit visiter en détail. C'est avec le plus grand intérêt que j'ai donc examiné les serres à multiplication qui répandent dans les colonies anglaises les plantes utiles à exploiter. J'ai été à même de me rendre compte que Kew était un grand centre d'activité coloniale, fonctionnant avec un mécanisme excellent. Un laboratoire et un herbarium complètent le Kew utilitaire. L'herbarium avec ses salles claires confortables, admirablement agencées pour les recherches, et ses armoires multiples où toutes les plantes sont classées d'une façon si simple et si ingénieuse, m'a particulièrement frappé. J'aurai tout dit du jardin de Kew lorsque j'aurai ajouté que ses travaux sont périodiquement publiés, et forment une série de publications fort appréciées et fort riches en renseignements pratiques concernant la flore tropicale."

Botanical Magazine for September.—*Eulophiella peetersiana*, certainly one of the most magnificent of the *Orchideæ*, is a native of Madagascar. The specimen from which the drawing was made flowered in the garden of Sir Trevor Lawrence, and produced a

scape three feet in length, bearing a massive raceme of rose-purple flowers, each about four inches in diameter. The view of the entire plant was prepared from a figure in the *Gardeners' Chronicle* and a coloured sketch by Mr. W. H. White. *Rhododendron yunnanense*, one of the numerous species from Western China, was sent to Kew by Messrs. James Veitch & Sons, in 1894. It is an ornamental plant and quite hardy. *Lobelia intertexta*, native of Central Africa, is nearly allied to the common *L. Erinus*. Seeds were received from A. C. Whyte, Esq., F.L.S., recently Head of the Scientific Department, British Central Africa. *Callistephus hortensis* was raised from seeds sent to Kew by Messrs. Vilmorin & Co., which were collected in Eastern Szechuen by the Abbé Farges. It is the wild "single" flowered state that is figured, and many persons will doubtless prefer it to its garden descendants. We must go back a century and a quarter (Trew's *Hortus*) to find a good coloured representation of the single China aster.

Flora of Tropical Africa.—The circumstances under which the continuation of this work, commenced in 1868 by Professor Oliver, has been resumed at Kew, at the instance of the Marquess of Salisbury, have been detailed in the *Kew Bulletin* (1894, pp. 17–18). The publication of the first part of Vol. VII. was announced on p. 24 of the present volume.

The third and concluding part has now been issued. It is accompanied by the following preface by the Director, under whose editorship the work is being prepared:—

"The 'Flora of Tropical Africa' has met with many vicissitudes. It was projected by Sir William Jackson Hooker as part of the series of Colonial and Indian Floras to be produced at Kew which he initiated. The immediate impulse which led the Government to sanction the undertaking was given by Dr. Livingstone on his return from the Zambesi Expedition (1858–64), to which Dr. (afterwards Sir John) Kirk had been attached as naturalist. The work having been offered to Dr. Kirk and declined by him, was entrusted in 1864 to Sir Joseph Hooker and Professor Oliver jointly, and was to be completed in four volumes.

"Sir Joseph Hooker succeeded to the Directorship of the Royal Gardens in 1865, and was in consequence obliged to resign the preparation of the Flora to Professor Oliver, although he contributed some share to both Volumes I. and II. Professor Oliver further obtained the assistance of other botanists.

"Vol. I. appeared in 1868, Vol. II. in 1871, and Vol. III. in 1877. It was soon evident that the work would exceed the limits at first assigned to it. Not less than five additional volumes will be now required to enumerate completely and describe the known plants of Tropical Africa.

"In the preface to the first volume Professor Oliver states that for the geographical region to which he gave the name Lower Guinea he was almost wholly dependent on the Angolan collections made at the cost of the Portuguese Government in 1853–61 by Dr. Frederick Welwitsch.

"This botanist, Professor Oliver adds, 'has freely granted us the opportunity of inspecting his collections, which, in respect

of judicious selection and admirable preservation, are without rival. His carefully accurate notes upon the fresh plants have also been at our service. Without the access to Dr. Welwitsch's Herbarium this region would have been comparatively a blank in the present work.'

"Dr. Welwitsch died in 1872, having bequeathed his Herbarium to the British Museum. This led to prolonged litigation on the part of the Portuguese Government, ending in a compromise. But the collections were no longer available for study at Kew, and Professor Oliver eventually abandoned the further prosecution of the work. He retired from his official post in 1890.

"Meanwhile the publication of the first three volumes had considerably stimulated botanical research in Africa. Sir John Kirk had become Consul-General at Zanzibar, and lost no opportunity of encouraging collectors. Sir H. H. Johnston, K.C.B., H.M. Commissioner in British Central Africa, imitated his example in British Central Africa. Much valuable work in Equatorial Africa was also done by the missionaries of the Church Missionary Society. The Temperate flora discovered on Kilimanjaro by the Rev. C. New, who was probably the first human being to reach its snow-line, and the collections subsequently made by Mr. Joseph Thomson on the mountains of East Equatorial Africa confirmed the relationships of the high-level floras of Tropical Africa with those of the northern hemisphere on the one hand and of the Cape on the other, which were first indicated by Mr. Mann's collections on the Cameroons. These relationships raise theoretical questions of the highest interest. The various Delimitation Commissions which followed the partition of the continent each yielded botanical results of more or less value. And the addition of new territories to the Colonies on the West Coast stimulated the desire of their Governments for an investigation of their vegetable products.

"The result was that an immense mass of material poured into Kew, and, though individual collections were worked out in a series of scattered papers, a general demand sprang up in foreign countries, as well as at home, for a comprehensive work which would sum up the knowledge which had been acquired, with no little expenditure of labour and even of life, of the vegetation of Tropical Africa.

"The desire eventually found expression in the following letter:—

"'FOREIGN OFFICE to ROYAL GARDENS, KEW.

"'Foreign Office, March 21st, 1891.

"'SIR,

"'I AM directed by the Marquis of Salisbury to state to you that his attention has been called to the fact that three volumes only of the "Flora of Tropical Africa" have as yet been published, and that the want of a complete handbook describing known plants impedes their study by Her Majesty's officers in the different parts of Africa which are now being opened up to civilisation.

"'A knowledge of African botany is of great practical value, as was proved by the discovery of Sir John Kirk, whilst employed

as Her Majesty's Agent at Zanzibar, of a plant previously unknown, which now supplies annually £200,000 worth of india-rubber to the Zanzibar market. So, too, on the West Coast of Africa, the trade consists almost entirely of vegetable products, some of which have only recently been brought to light.

" 'Lord Salisbury is of opinion that a proper knowledge of the flora of Tropical Africa would do much to aid the development of the territories over which this country has recently acquired an influence, and he would therefore suggest that the completion of the work in question should at once be carried out.

" 'I am, &c.,

" '(Signed) T. V. Lister.

" 'The Director, Kew Gardens.'

" In replying to this letter I pointed out that my scientific staff was so occupied with routine work that it was impossible to treat the completion of the Flora as a matter of official duty. If, however, as in the first instance, it was regarded as an extra-official undertaking, I was willing to do my best, with such voluntary assistance as I could obtain, to assist Her Majesty's Government in getting the work completed. It was accordingly agreed that a commencement should be made in 1892. Much preliminary labour had to be accomplished, and in order to avoid the inconvenience of anticipation, provisional technical descriptions of new African plants received at Kew were drawn up by members of the staff and officially published in the *Kew Bulletin*. These were available for working up subsequently in the Flora. The number of species so published up to the present date amounts to more than 800.

" A list of the known plants occurring in British Central Africa, amounting to upwards of 1,800, compiled from the Kew records by a member of the Kew staff, Mr. I. H. Burkill, M.A., is printed in Sir H. H. Johnston's 'British Central Africa,' pp. 233–284, prefaced by a brief history of botanical exploration in the Protectorate (see *Kew Bulletin*, 1897, pp. 170–171). It is estimated that the number of species would be increased by the intercalation of recent additions to 2,500.

" As to the general scope of the work, it will be convenient to quote the following passage from Professor Oliver's preface to the first volume. It still in great measure holds good :—

" 'From our very imperfect knowledge of the vegetation of many parts of the Continent, even of those which have been long more or less in European occupation, and from our complete ignorance of that of the immensely larger area not yet opened up, the present work must not be regarded as presenting anything like a complete account of Tropical African Botany. It serves rather as a vehicle for the publication of the important botanical results of much recent expenditure of life, toil, and money, which would otherwise have been lost to science or anticipated by other nations, and (embracing references to all hitherto published African species) as a repertory which it is hoped may be useful to botanists, no less than to future explorers and residents in Africa interested in the natural productions and economic products of the country.'

"In the mode of execution the pattern of the published volumes has been closely adhered to. I may again quote Professor Oliver's preface :—

"'The "Flora of Tropical Africa," forming one of the series of Floras undertaken, at the instance of the late Sir William J. Hooker, under the authority of the Home or of Colonial Governments, it is necessarily uniform in general plan with those which have been already issued.

"'The principal features of this plan, as settled by Sir W. J. Hooker, and described in his report, are these :—

"'1st. The descriptions are drawn up in the English language, Mr. Bentham's "Introduction to Botany, drawn up with special reference to Local Floras," containing the technical terms used in the descriptions, being prefixed to the work.

"'2nd. The general sequence of Natural Orders adopted is that of the "Prodromus" of De Candolle, being that which experience has shown to be practically the most convenient. In accordance with this sequence, British botanists are accustomed to arrange their Herbaria and works of Descriptive Botany. In the more detailed arrangement of the genera, the "Genera Plantarum" of Messrs. Bentham and Hooker has been followed, and a reference to that work is given with each genus.

"'With regard to the synonymy of the species here described, while the authors have endeavoured to quote all names which have been applied to Tropical African plants, they have not, in the case of widely diffused species, regarded it as either necessary or desirable to include their whole synonymy, the reliable citation of which would have involved very much more time, labour, and space than the end to be attained would warrant; besides that, it would be out of place in a special work of this kind. Any new identifications of African with extra-African species are, of course, recorded.'

"In one particular, however, I have been obliged to depart slightly from the plan of my predecessor. The last of the three published volumes of the 'Flora of Tropical Africa' appeared in 1877. Since then our knowledge of the vegetation has increased very greatly. Large tracts which were unexplored botanically at that date have yielded numerous and copious collections. In resuming the work, it has therefore been found necessary to more clearly define the regions into which Professor Oliver divided the whole area. In attempting this, advantage has been taken as far as possible of political boundaries, since they admit of easy recognition. The regions may now be briefly defined as follows :—

"UPPER GUINEA.—The Western Coast region from the mouth of the Senegal river to the southern boundary of the Cameroons. It contains practically the whole of the Niger Basin. It is bounded on the north by a line stretching from the mouth of the Senegal River to Lake Chad; on the east by the 15th meridian of East longitude to its intersection with the southern boundary of the Cameroons, which bounds it to the south. It includes also the island of Fernando Po.

"2. NORTH CENTRAL.—This includes the Sahara. It is bounded to the north by the Tropic of Cancer; on the west by

the Atlantic; on the east by the 26th meridian of East longitude; on the south by the Upper Guinea region and the Congo Free State.

"3. Nile Land.—The Nile basin. It is bounded to the west by the 26th meridian of East longitude; to the east by the Red Sea and the Indian Ocean; to the south by the Congo Free State and German East Africa.

"4. Lower Guinea.—The Western Coast region from the southern boundary of the Cameroons to the Tropic of Capricorn. It contains the lower course of the Congo, and is bounded to the east by the Congo Free State, the river Kwango, and the 20th meridian of East longitude.

"5. South Central.—Comprises the Congo Free State, Lunda and Portuguese West Africa, east of the 20th meridian of longitude (Lobale).

"6. Mozambique.—The East Coast from the northern boundary of German East Africa to the Tropic of Capricorn. It includes Portuguese East Africa and British territories to the Tropic.

"In the preface to the first volume Professor Oliver enumerated the materials which he had employed. These it is not necessary to recapitulate. Copious accessions have, however, reached Kew since 1868, and the more important of these are enumerated below.

"1. Upper Guinea.

"G. L. Bates. Plants of the Cameroons.

"Captain (afterwards Sir Richard) Burton and Commander V. L. Cameron. A small collection from the Gold Coast. Surgeon-Captain H. A. Cummins. Plants collected during the Ashanti Expedition of 1895–6. (See Kew Bulletin, 1898, pp. 65–82.)

"G. F. Scott-Elliot. A large collection made during the Anglo-French Sierra Leone Delimitation Commission of 1891–2. (See Journal Linnean Society, Botany, vol. xxx., pp. 64–100.)

"Professor A. Engler, Director of the Royal Botanical Gardens and Museums, Berlin, has contributed the collections of Braun, Preuss, Staudt and Zenker from the Cameroons.

"Dr. H. H. Johnston. A small collection from Sierra Leone.

"Sir H. H. Johnston, K.C.B. A collection from the Cameroons.

"Dr. Brown Lester. Plants collected during the Anglo-French Gambia Delimitation Commission, 1890–1. (See Kew Bulletin, 1891, pp. 268–275.)

"H. Millen, Curator, Botanic Station, Lagos. Kew Bulletin, 1892, p. 72.)

"Alvan Millson, Assistant Colonial Secretary, Gold Coast. Plants from Yoruba. (See Kew Bulletin, 1891, pp. 206–219. Died 1896.)

"Sir Alfred Moloney, K.C.M.G., late Governor of Lagos. A small collection of Lagos plants.

"Dr. Rowland, C.M.G., Chief Medical Officer, Lagos. Plants chiefly collected during the Expedition undertaken by Sir Gilbert Carter, K.C.M.G., late Governor of Lagos, into the interior. (Kew Bulletin, 1893, pp. 146 and 369.)

"H. Veitch, F.L.S. Collection made by Kalbreyer in the region of the Niger Delta and Cameroons.

"2. North Central.

"The material still remains extremely scanty, and nothing of importance has been added.

"3. Nile Land.

"Mons. W. Barbey. Dr. G. Schweinfurth's collections from Eritrea.

"Miss Edith Cole and Mrs. Lort Phillips. A collection from Somaliland. (See Kew Bulletin, 1895, pp. 158 and 211–230.)

"G. F. Scott-Elliot. A large collection from British East Africa made during the Ruwenzori Expedition, 1893–4. (See Kew Bulletin, 1895, pp. 77–78.)

"Professor A. Engler has communicated the plants of Steudner from Abyssinia and of Stuhlmann from Ruwenzori.

"Dr. J. M. Hildebrandt. Collection from British East Africa. (Died 1881.)

"Sir H. H. Johnston, K.C.B. Collections made during the Kilimanjaro Expedition. (See Transactions Linnean Society, Second Series, Botany, vol. ii., pp. 327–355.)

"Dr. G. Schweinfurth. Collections from the upper tributaries of the Nile.

"Rev. T. Wakefield. A collection from British East Africa, chiefly near Mombasa.

"Rev. C. T. Wilson. A collection from Uganda and Unyoro.

"4. Lower Guinea.

"G. L. Bates. Plants from Gaboon.

"Professor J. A. Henriques, University of Coimbra. Collections from Island of St. Thomas, collected by F. Quintas and A. Moller.

"Sir H. H. Johnston, K.C.B. A collection from Angola.

"J. J. Monteiro. Plants from Angola. (Died 1878.)

"Professor Hans Schinz. Plants from German South-West Africa.

"H. Soyaux. Plants from Gaboon and Loango.

"5. South Central.

"The vegetation of this region, which includes the Congo Free State, is, although undoubtedly very rich, almost entirely unknown. Professor Engler has communicated plants collected by Buchner, Büttner and Pogge. A part of Dr. G. Schweinfurth's collections (from the Monbuttu country) also belong to it.

"Professor Oliver states in his preface that Sir John Kirk's collections on the Upper Zambesi had been lost. They were despatched to England in 1861 on H.M.S. 'Sidon,' and were never heard of again till they were discovered in Portsmouth Dockyard in 1883.

"6. Mozambique District.

"Right Honourable James Bryce, F.R.S. Plants from Mashonaland.

"J. Buchanan, C.M.G. A large collection made in Nyasaland. (Kew Bulletin, 1892, p. 249; and death, 1896, p. 148.)

"K. J. Cameron. Collections from Nyasaland.

"Commander (afterwards Captain) V. L. Cameron. Plants from the neighbourhood of Lake Tanganyika. (Died 1894.)

"Alexander Carson, B.Sc. Plants from South of Lake Tanganyika. (See Kew Bulletin, 1893, pp. 343, 344; 1895, p. 46, pp. 63–75 and 288–293; and death, 1896, pp. 148–9.)

"G. F. Scott-Elliot. Collection from German East Africa and Nyasaland, made during the Ruwenzori Expedition, 1893–4.

"Professor A. Engler has presented collections, rich in novelties, from Usambara and various other parts of German East Africa, made by Baumann, Fischer, Holst, Stuhlmann, and Volkens. (Kew Bulletin, 1897, p. 241.)

"Bishop Hannington. Plants from German East Africa. (Assassinated 1885.)

"Dr. Emil Holub. Collection from Rhodesia, South of the Zambesi.

"Rev. W. P. Johnson. Collection from mountains East of Lake Nyasa.

"Sir H. H. Johnston, K.C.B. Collections from Nyasaland and Kilimanjaro.

"Sir John Kirk, G.C.M.G. Plants from Zanzibar and other parts of East Tropical Africa.

"J. T. Last. Collection from Namuli Mountains in Portuguese East Africa and Nyasaland.

"Dr. Livingstone. Eight fragmentary specimens found in his pocket-book after his death.

"Major F. D. and Lieutenant E. J. Lugard. Plants from Ngamiland. (Kew Bulletin, 1897, p. 242.)

"J. McClounie. Plants from Nyasaland. (Kew Bulletin, 1895, p. 158.)

"Rev. C. New. Collection from Kilimanjaro. (See Journal Linnean Society, Botany, vol. xiv. pp. 141–6. Died 1875.)

"Dr. T. G. Nicholson. Plants from North Nyasaland and Upper Loangwa River.

"W. H. Nutt. Plants from South of Lake Tanganyika.

"F. Oates (presented by C. G. Oates). Plants from Matabele-land. (See "Matabele Land," 1st ed. pp. 366–369; 2nd ed. pp. 390–413. Died 1875.)

"L. Scott. Plants from Portuguese East Africa and Nyasaland.

"Lieutenant C. S. Smith. Plants from Umba Valley, German East Africa, collected during the Anglo-German Delimitation Commission. (Kew Bulletin, 1893, p. 146.)

"Joseph Thomson. Collections from the neighbourhood of Lakes Nyasa and Tanganyika. (See Journal Linnean Society, Botany, vol. xxi. pp. 392–406. Died 1895.)

"Alexander Whyte. An important collection from Nyasaland. (See Kew Bulletin, 1897, pp. 241, 243–300; 1898, pp. 145–164.)

"As soon as I was able to organise the necessary staff the work was attacked at various points. But some time necessarily elapsed before sufficient material was accumulated to commence printing

When a work of this kind is once planned out, it is immaterial what part is first issued. I eventually decided to first issue the present volume (the seventh), devoted to the Petaloid Monocotyledons, as these groups of plants are of wider general interest. The printing of the volume commenced in July of last year, and has been attended with very considerable difficulties. Whether it is followed by any other volumes will largely depend on the extent to which these difficulties are removed.

"I have to express my obligations for the sympathetic assistance I have received from the following foreign botanists :—

"Mons. W. Barbey, Herbier Boissier, Geneva.

"Professor Bureau, Jardin des Plantes, Paris, who has obligingly lent the specimens of *Liliaceæ* from the French Congo described by Mons. Henri Hua.

"Professor A. Engler, Director of the Royal Botanical Garden and Museums, Berlin, who has communicated important collections made by German travellers, as well as numerous publications.

"Professor Th. M. Fries, Director of the Botanic Gardens, Upsala, for the loan of the types of Swartz's orchids.

"Dr. Hans Schinz, Professor of Botany, Zurich.

"I have further to record my acknowledgments of the assistance given me by Mr. C. H. Wright in preparing the manuscript for the press and in checking the proofs, and to Mr. N. E. Brown for working out the geographical distribution.

"For the detailed topography the third edition of the "Spezial-karte von Afrika," Gotha : Justus Perthes, 1893, has been chiefly used.

"W. T. T. D.

"Kew, Aug. 1898."

Records of the Botanical Survey of India.—Number 9 of this publication consists of a Report on the botany of the Chitral Relief Expedition, by Mr. J. F. Duthie, Director of the Botanic Department of Northern India. The plants were collected by General Gatacre, C.B., Colonel Davidson, Lieutenant-Colonel Hamilton, and Surgeon-Lieutenant Harriss. Nearly a thousand species are enumerated, belonging to 459 genera and 93 natural orders. The list has a special value, inasmuch as the altitudes are carefully recorded. It is gratifying to find so many officers of the army taking an active interest in botany.

Number 10 is devoted to an interesting account of a botanical tour in Chamba and Kangra, by Mr. G. A. Gammie, supplemented by a list of the plants observed.

Sisal in the Turks Islands.—The following is an extract from the Annual Report on the Turks and Caicos Islands. (*Colonial Reports, Annual*, No. 230, p. 7.) :—

The value of Sisal hemp exported was £2,539, or more than double the figure of the previous year, and extraction and export are steadily continuing. At present prices the outlook for plantations where the growth has been successful is rather more encouraging than it has been for some time.

Palmetto Straw from Turks Islands.—The following is an extract from the Annual Report on the Turks and Caicos Islands. (*Colonial Reports, Annual*, No. 230, p. 8.) :—

A very small minor industry, the collection and export of Palmetto straw, which gives employment to women and children in some of the Caicos Islands, has come into evidence again, owing principally to the troubles in Cuba, which have, as I understand, caused the supply ordinarily obtainable from there to fail.

Amomum angustifolium, Sonnerat. Voy. Ind. iii., 276, t. 137.—This plant is widely distributed in tropical Africa. A full description with localities is given in the recently issued *Flora of Tropical Africa*, Vol. VII. (pt. ii.), p. 308. Under the name of *A. Danielii* it is figured in *Bot. Mag.*, t. 4,764. There has hitherto been no record of its being of economic value.

The following extract from a letter received from Mr. John Mahon, formerly of Kew and now attached to the Scientific Department of the Administration of British Central Africa, gives some interesting particulars of this plant. The "Korarima Cardamom," for which this plant was taken by Mr. Mahon, is still unrepresented in the Kew Musuem :—

EXTRACT from letter from Mr. J. Mahon to Royal Gardens, Kew, dated Zomba, British Central Africa, June 6, 1898.

The receipt of the Cardamoms has reminded me to write you concerning a plant fairly common by stream sides and in moist gullies here which I take to be the "Korarima Cardamom" referred to in *Kew Bulletin* (1894, p. 400). I sent seeds of this with ripe fruits some time back to Kew, and also a specimen of the flower. The plant flowers in November, and last season I collected and dried several specimens, but during one of my absences from Zomba my boys cleared them out and only the flower sent remained. I am sure, however, the Herbarium must possess foliage and stems of such a striking plant. I am now drying stems which I will forward when ready, and I shall get more flowers when the time comes. I have recently collected a few ripe fruits and sun-dried them and these are sent in this mail in order to obtain your opinion whether they might become a marketable commodity. The seeds possess a decided spicy flavour. I think drying adds to their pungency. The natives eat the ripe fruits raw occasionally and, I believe, use the seeds sometimes as a flavouring ingredient. The Yaos call it "Tambali" or "Tambala." It is a handsome and striking plant, often reaching a height of 15 feet. The fruits, often produced in clusters of three, are a brilliant, shining scarlet. The flowers are of a tawny-orange colour with some rose-coloured markings; they are produced in dense compact clusters almost impossible to dry *en masse* owing to their containing so much water. Roots that I have had taken up possess very little aromatic or ginger-like properties, indeed the leaves are richer in aroma.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 143.] NOVEMBER. [1898.

DCXXVII.—A BUDGET FROM YUNNAN—continued.

The following letter is in continuation of those printed in the *Kew Bulletin* for 1897, pp. 99–101, and 407–414.

Dr. A. HENRY to ROYAL GARDENS, KEW.

c/o Customs, Szemao, par Loakai,
Tongking, 8th June, 1898.

DEAR MR. THISELTON-DYER,

I NEED hardly say how very welcome to me was your letter, so full of interesting matter of all kinds. I know very well how busy and occupied you are all the time, so I don't expect to hear often from you. More is the pity, as letters are the only stimulant of a healthy kind an exile has to cheer him up in moments of depression, and to remind him that there is a fair world on the other side of the globe, where men and women live. On this side there is an all-prevailing stagnation, which depresses the stoutest heart by its constancy and immovability, and as one grows older the less one seems to like isolation.

I left Mengtze in the end of January with a caravan of mules, some 40, carrying stores, &c. I had three mule-loads, *e.g.*, of silver. The journey here took 18 days, rather easy stages. The country passed through was very varied. I was in good spirits, rode nearly all the way, and enjoyed the trip very much. I crossed three large rivers *en route* by pontoon and suspension bridges, the latter very well made, of iron rods joined by rings at the ends, the best specimens I have seen of Chinese blacksmith's work. At these river crossings we reached low levels, about 1,800 feet above the sea, and came into tropical vegetation, which I never find at all interesting. At Yuenchiang, on the Red River, the ugly-looking shrub *Calotropis gigantea* was in flower, and there was a great display of the tree-cotton, *Bombax*, in flower, without any leaves, looking like an artificial candelabrum affair more than a living tree. These and some *Areca* palms were the

only things of note. At the higher levels vegetation was at a dead point and I collected very little, one or two species of *Clematis*, two Rhododendrons: the very curious *Scolopendrium Delavayi*, which I had never seen before, I found one day on a shady bank where I stopped for tiffin. I also found, at the same place, two plants of *Abutilon sinense*, which had been sent by me from Ichang, and an *Antrophyum*, which may be new. I also came across *Lonicera Bournei* in flower; it is of no value as an ornamental plant. There was very little forest until after Talang, when we passed one or two days through almost continuous pine forest, varied here and there by little woods of evergreen oaks. Here, rather to my surprise, I learned that the peacock exists in the wild state, and it is quite common in the forest south of Szemao. These pine forests had not a plant in flower amongst them. I noticed, however, two little woods made up of an *Abies*, new to me, but I only found one cone. However, I am not pretending now to give any account of the trip botanically, as it would require too much time to get my notes in order at the moment. On the eighteen days I may have collected about 30 plants in flower. At one or two places I might have done a lot of collecting if I could have stayed for a day or two, but I was travelling on official business, and could not tarry.

The main interest of the route was the aborigines, or non-Chinese races. Chinese here and there dwell on the little tracts of good land which are found in the high-lying valleys and plains of the plateau, and I passed through five or six largish towns mainly peopled by Chinese. But the larger part of the population was made up of aborigines. On the north side of the Red River, Lolos are predominant. At Yuenchiang, on the Red River, is a large plain occupied by Shans, and I was lucky enough to arrive on a festival day, and the gaiety of the skirts and jackets, and head-gear of the Shan women made them look like so many butterflies. South of the Red River, in the very barren mountains, the Wo-ni are the chief inhabitants, a swarthy people addicted to cattle-lifting. They speak a language akin to that of the Lolos. There are many sub-divisions of the race, and the variety of dress of the women is extraordinary. Some wear open jackets, and trousers six inches long; others are clad in long gowns braced across the bosom slantingly, in Amazon fashion, and these carry a head-dress which is reminiscent of a college-cap magnified ten diameters. I saw some little Kadoo girls, tiny creatures dressed in European skirts. In the valley of the Papien river, near the suspension bridge, I was lucky enough to come across a party of five Yao hunters. They were dressed very neatly in jackets with countless silver buttons, dark turbans, and tightly bound leg-gear, and carried handsome guns of native workmanship. This strange race lives in isolated communities in the mountains from here east to the Kwangsi province, and they indulge in little cultures, like the medicinal plant san-ch'i, indigo, etc. Nothing is known about them. My five hunters were fine manly chaps, very frank and friendly.

On the way I captured a Lolo *literatus*, and he stayed with me here two months, and I have read through two or three of their MSS., the script of which is very peculiar. It is made up of characters hieroglyphic originally, but having very doubtfully any

connection with Chinese. No printed books exist, and these MSS. deal mainly with religious ritual. The Lolos are little influenced by Buddhism, and they are chiefly concerned with devils, ghosts, and goblins, whom they exorcise out of human beings and houses by reading rituals and offering sacrifice. I picked up in my limited reading some very curious bits of folk-lore. They have a very definite legend of the deluge, one man being saved, whose six sons are the ancestors of the present races of mankind. Before the deluge, human beings were cyclopes, only possessed of one eye. In these olden days, people lived to 500 and 600 years old, &c., &c. One would fancy that some Jews or Christians were in Yunnan in early days. This is a grand province for the Psychical Society, as it is peopled with very troublesome ghosts and demons of all kinds, which everyone believes in. The Lolo language is tonic, and in syntax is like Chinese, except that the adjective follows the noun, whereas in Chinese it comes before. The composition of words is ingeniously simple. A gun is "fire-hit," gunpowder is "fire-rice," a snare is "take-get," a bucket is "two ears projecting," lightning is "the sky winks." My Lolo has gone home, promising to return, but I am a little afraid I shan't see him again, and my study of Lolo ways for the moment has been brought to a stop.

Szemao is the end of China. To the south is Chienhung, a collection of little Shan States, dependent on China at the moment, as Britain didn't claim them on taking Burma. The Yunnan plateau is still here and goes on south, if one can call a plateau a collection of mountains rising to 6,000 feet, with intervening valleys averaging 4,000–5,000 feet, occasionally widening out into plains of a few miles in width and length. The mountains are being colonized by Lolos and Chinese, while the valleys are in the hands of the Shans, who live by cultivating rice. They are a lazy and immoral people, and have none of the industrial virtues of the Chinaman. The boys are reared in temples, where they officiate as acolytes and young priests. The girls roam about from village to village independent of paternal control. Other races appear to the south and west, viz., the Akas, who do the hard work for the Shans, and the Kawas, in the west, noted for scantiness of clothing and bloodthirstiness of disposition.

Whether the ethnology of this part of the world will ever be satisfactorily explained is doubtful. There seems to be the same variety in the human being as exists in the vegetable world in the same region, and there is a strange blending of races of Chinese, Malay, Negrito, perhaps even Caucasian here.

As much is talked of Yunnan at home, it may be as well to say that all that talk is full of an astonishing ignorance. Yunnan is a poor province, and is impracticable, from physical reasons, for railway schemes. The only possible railway may be one connecting the capital Yunnan with Tongking, and it will scarcely ever pay. As Yunnan is the foreland, of which Szechwan and the Yangtze valley are the hinterland, it may be necessary for England to extend one Burmese railway into Yunnan, but it will be a very costly and unremunerative enterprise. Yunnan, in fact commercially, under its present Government, isn't worth a rap. Whether its mines would pay is another question. There were

salt mines, and one gold mountain, passed by me, on my way here. The gold mountain produced 1,000 ounces of gold annually ; not much. It being Chinese New Year time, the salt mines (a Government monopoly) were disposing of salt minus one of the taxes on it, and the result was that the roads were thronged with people carrying salt. The wild inhabitants of the mountains came out, for once in the year, out of their fastnesses, and I think it is a fairly correct theory which makes out salt to be the first commerce engaged in by human beings. These aborigines otherwise never stir away from home, and any trade they have is with some Chinese town, the nearest to their home. If there were not Chinese, it is doubtful if there would be any trade at all, except the annual pilgrimage for salt to the salt mines. The constant staying-at-home, for centuries, has no doubt kept up the extraordinary number of different tribes, languages, &c., now existing in these parts.

In the Shan States south and east of Szemao, there is a good deal of cultivation of tea, the so-called P'u-êrh Tea, concerning which you have published in the *Kew Bulletin* (1889, pp. 118–120 ; 139–142), a lot of information, mainly gathered by Bourne on his trip here, some years ago. This tea is sent to all parts of China and to Tibet. I have an idea that this region is, perhaps, the site of the earliest cultivation of the tea plant ; but this section of country was until modern times a Shan principality, and China only extended earlier as far south as the Red River. Shan historical records have not been studied ; I presume that they exist. Many of the place-names here are Lolo. Szemao in Lolo means " Old blood," Talang is the Lolo *Ta-la*, pine-forest, &c. The ancient independent kingdom of Yunnan is generally supposed to have been a Shan one ; but I think that the possession of a written character by the Lolos indicates that they once were a people with independent government and considerable civilization.

The Tibetans, who come here with a few caravans, twice a year for tea, are fine, big, strapping fellows, with loud voices ; a pair of them measured 6 feet 4 inches in height. These belong to the Ku-Tsung tribe. The difference between them and the other races is so marked that one almost fancies the Ku-Tsung to be of our own race (of course, really they are not). The other races, *i.e.* Chinese, Shans, Lolos, Wo-ni, and the Annamese and Siamese, all belong to a Pan-Cathayan family, black-haired, oblique-eyed, almost beardless people, speaking languages characterized by tone. With these races the European has little sympathy ; he doesn't care for their virtues, and dislikes their vices and faults intensely. That the Chinese have great brain-power, and many solid virtues is undoubted ; and the mere abolition of their present government and substitution for it of European government by the contemplated partition policy, will only the more speedily bring to the front the antagonism and competition between the yellow and white races, which is a mighty question in the future. I think on this question that the yellow race is by nature well-adapted to be the hard-working servant, in the hotter regions of the world, of the more vigorous white race, which will doubtless stick to temperate regions.

The greatly increased interest in China at home will, I hope, give a stimulus to the study of the history of the social evolution of the Chinese, which is calculated to bring out many important lessons for ourselves. There have been, as it were, two parallel developments of the human race, one on the west of Europe-Asia, the other on the east side, very little dependent on each other. At the start, the Chinese seem to have been fairly equal to the Westerners; and even in the middle ages, judging from the way in which mediæval travellers wrote, Chinese civilization was quite as good as that of Europe. Whence the decay on the east, the increasing vigour on the west? It is rather trite to say that the Chinese anticipated us in many things. They had a feudal system long before Europe had, and gave it up very early. They had an interesting experiment in socialism many centuries ago; they tried collectivism; the State managed all business affairs, was the only employer of labour, and distributed the profits to all in equal shares. Less than twenty years trial of the system showed it to be a crime against human nature. They have anticipated all our current fads; they have for centuries adopted peace-at-any-price as the highest morals, and have despised war and soldiers. As a result, they have had the most ruthless massacres, occurring in countless rebellions; and general insecurity besets them both as regards interior policing and protection from foreign aggression. Needless to say that they have for years gone in for the competitive examination, and have as a result a body of truly incapable officials. It is usual to consider the Government of China as an autocratic one. It is nothing of the sort, it is on a thoroughly democratic basis, the democracy of the Tammany Ring kind. There is no country in the world with less of aristocracy, and the result is not encouraging to those who sigh for abolition of the House of Lords. I doubt if one can rightly attribute any of the decay of China to the absence of christianity, for Europe owes its progress much more to Greece and Rome, than to Israel. In China, woman has never been in a position of honour and trust and influence. This is an ancient failing. The hieroglyphic for woman occurs in many hundreds of characters, some indicate female relationship, but all the rest, save one, indicate vices and failings, words such as envy, lust, &c. The exceptional character, *hao*, good, is made up of woman and son; but some Chinese say it is only an apparent and accidental exception, the character originally meant something else.

The decay of manly spirit, brought about by the idea that war is immoral, the low position of woman, the absence of an hereditary aristocracy holding up ideas of honour and probity and constantly acting as a check on philistinism, the government by officials selected by competitive examination in ancient classics and trivialities akin to Latin verse, all these causes must have been acting disastrously to have brought an intelligent race into such a low position.

There is a good deal of wooded country at no great distance from Szemao, and the mountains run up to nearly 6,000 feet, but there is an absence of the sharp and precipitous kind of mountain and valley, and the flora in consequence is very uniform and not nearly so interesting as Mengtze nor so rich in species. Hills clad with pine and oak are almost barren in interesting plants,

and I haven't come on any of those dark ravines and steep wooded cliffs which are the joy of the botanical collector. There is a great absence (perhaps the autumn will make a better show) so far of ferns and herbaceous plants. What one collects is mainly trees and shrubs and climbers. There is a fair number of epiphytic orchids. The common plants are not the common plants of Mengtze, in fact the two floras are very different. Szemao will possibly turn out very like the Shan country where Sir Henry Collett collected, and Indian forms not hitherto recorded from China are frequent enough. The commonest tree after the pine and the evergreen oaks (of which there are perhaps ten) and *Castanopsis*, is *Schima Wallichii*. There are four or five Laurineæ, a *Halesia*, a *Eugenia*, *Itea macrophylla*, *Meliosma*, two Rhododendrons, a tree *Callicarpa*, seven or eight species of *Ficus*, a *Magnolia;* to mention the first which come to my mind. *Rubus* is represented by five species, one new to me ; and in China one always expects to meet a new and very distinct *Rubus* after travelling 20 miles in any mountainous part. *Rubus ellipticus* appears in its ordinary form in the forests with large soft pointed leaflets. From Mengtze to here and to Talifu, a very distinct variety occurs, with smaller, harder, rounded-off leaflets, and this variety occurs in the open country, on poor bad soil, in dry barren exposed places. It is quite evidently a case of adaptation. The variety has rather pleasant yellow raspberry fruit, produced in great profusion, and I think it might be of service to gardeners in places where they wanted to grow raspberries on very bad soil in dry arid climates. In the dry pine and oak woods a *Cycas* occurs, with a stem 2 or 3 feet high, but it has not as yet flowered. There is also a fern in the same locality, which I have not seen with spores, which has precisely the same habit as the *Cycas*. The leaves of both are so hard that they can stand, I should think, any amount of drought, and that is necessary here, as little or no rain falls during more than half the year. At Mengtze limestone was the prevailing rock ; here it is a red sandstone, and this may account in part for the poorer flora. I have always found limestone to be richer in interesting plants than any other kind of rock. One curious thing occurs here as well as at Mengtze, *i.e.*, the occurrence of two or three species of the same genus in precisely the same locality and often flowering at the same time. There are two climbing Loniceras, *e.g.*, here, which are to be met with together, flowering together. One of the Rhododendrons is very lovely ; it is a bush some four or five feet high. The flower-buds are a delicate red, and the flower just on opening is flushed with pink ; the pink disappears, and the flower, 3 or 4 inches in diameter, becomes a pure white, except for a dash of yellow on the interior of the upper petal. This dash of yellow on one petal of an otherwise pure white flower occurs in other species of Rhododendron. I have not seen a rose as yet, but *Rosa gigantea*, I believe, occurs. The common *Melastoma candidum* looks as if it were a rose at a distance, and is almost everywhere. The difference between this shrub and a rose expresses exactly the difference between sub-tropical and temperate vegetation. The latter is in some mysterious way much more beautiful and satisfactory to the eye. I was quite pleased to read the other day in a notice in the *Saturday Review* a savage invective against

florist's flowers. It does seem a pity to spoil the simply beautiful flowers by converting them into monstrosities with crested appendages, &c., &c. Of course, as scientific experiments the cresting, doubling, &c., are all right and interesting, and your account of the Cyclamen I read with much interest.

The woods near Szemao are full of birds, and the notes are exquisite, and to be heard in perfection in these days of showery weather, for the rainy season has begun. When the sun gets out the cicadas start such a racket that one can hear nothing else. I have not told you of the jungle-fowl; this is, I believe, *Gallus bankiva*, the original form of the farmyard fowl. They are very common in the forests and woods here, and are simply gorgeous. They are glorified bantams, the colours having a brilliancy that seems abated in the domesticated kind. They crow and cackle and behave in the woods just as a farmyard fowl would do, only they are a little shyer of man. Occasionally one sees a flying-squirrel, a big black one, sailing in the air from tree to tree, and I saw the other day what I thought was a calf; it turned out to be a red-coloured deer, which speedily bolted with an up-turned tail, white beneath like a rabbit's. It is very hard to believe that this particular deer, which only occurs, so far as I know, one or two together, never a herd, derives much advantage in life from this white-signal tail. Further south there are very large deer with branching antlers, and their horns when they are in a "young" condition, velvety at the bases, are worth to Chinese pharmacists as much as $50 a pair. Elephants, wild cattle of some kind, wild boars, bears, &c., all occur in the same large forests lying to the south.

I am afraid there will be no chance here of getting hardy bamboos. Bamboos of that character do occur in the higher ranges of Yunnan, but who is to go there at the time when they are in seed, once every 60 years, the Chinese say.

I am sorry about the non-success of the lily bulbs; but you have received seeds of the species. I am afraid there will be little here of a hardy nature, but there are a few things of which I shall try to send seeds later. Is it worth while sending seeds of orchids? Yesterday I came across a very peculiar terrestrial orchid, with tiny flowers (½ in.) like beetles. I also found in the same place a little undershrub, about 6–8 in. high, with pinnatifid leaves and very long (3 in.) cylindric-tubed, rotate-limbed, white flowers. I think it is a curious *Solanacea*, but I am not certain, as I have not examined the flowers carefully. It would be rather pretty in cultivation. These I found on a bit of cliff which I stumbled against for the first time. There are also two little palms here, which I hope to get in fruit later on. Has *Burmannia* been in cultivation, any species, with you? There is a species here and at Mengtze, occurring in wet grassy places at high elevations, and the flowers, deep blue, while not very large are very curious, and a number of plants massed together would be pretty enough. It is a representative of a very small family, and I don't understand what trick the flowers are up to in their peculiar shape.

In many of the Mengtze and Szemao trees and shrubs the flowers occur on the branches below the leaves, and not on the peripheral surface of the tree, as in ordinary cases. Many lianas

have this peculiarity. These are all forest plants, and I think the explanation is that in forests there are two surfaces open to insect-visitors, the top of the forest and the bottom. Some trees and shrubs and climbers can't get to the top, so they have their flowers at the bottom. But of course this explanation is only a guess. There is no time for me to make any observations of the kind necessary; if one could spend six months on end in a forest, one could observe, measure, &c. The *Mucuna sempervirens* of Ichang was a splendid example of this peculiarity. There was in one specimen a dense wall of foliage climbing over trees, interlaced with them, &c., nearly 200 ft. by 100 ft., while the main trunk of the climber close to the ground was covered with flowers which were easily visited by thousands of insects of all kinds.

There is quite a little group of shrubs which occur on the banks of rivers (and often in beds of streamlets) that overflow. These shrubs are submerged often and are not hurt. These *fluviatile* shrubs have a certain facies, very difficult to describe. There must be 30 or 40 species of them in the Yunnan river valleys. These shrubs don't occur elsewhere than on banks or in the beds of streams. The last one I have found is a very fine species of *Ficus*. This class of shrub would be a nice enough problem for someone to work out.

I hope you will try and get a young Cambridge or Oxford botanist to come to this part of the world, do some naturalist work, and collect seeds and live plants for cultivation. China is a very easy country to travel in, and expenses of travelling are not heavy. The mountainous regions of Yunnan and Szechwan are very healthy besides.

With regard to San-ch'i (the species of Aralia § Panax), the medicinal plant of which I have sent you herbarium specimens and seeds, I will try and send a note on it for the Bulletin by next mail. It would be a favourable opportunity, if one of the staff had time, to go through the section and make a little synopsis of it. It includes the American ginseng plant, Corean ginseng, and two or three other species, and I found some forms at Ichang which were not worked out. The forms seem to run into each other in a puzzling way. It is very curious that the Chinese should have selected two forms—one in the extreme north of the empire (Manchuria and Corea), the other in the south, near Mengtze—as two most powerful and famous drugs. There is something peculiar about the history of certain drugs which European doctors consider useless. Take sarsaparilla and china-root, species of *Smilax*, much believed in by native American races and by the Chinese.

With regard to Benzoin, it is not known here; but our Consul will probably take a trip by-and-bye down into Siam, and I will try and induce him to make enquiries for the tree. Have you tried writing on the subject to the British Consul at Chiengmai, in Siam? The Yunnan plateau is apparently continued into the Shan States, and teak, benzoin, &c., are probably confined to the lower levels lying south.

I have some specimens—only leaves—of the tree which produces the very valuable cinnamon of the Laos, but I am afraid they will not help much in clearing up the species. They were brought to Mengtze by a pedlar after I had left the place.

I have said nothing in my letter about recent events in China, but they are very important. It is impossible to believe that China will remain hopelessly stagnant, and that she will make no effort to cope with these disastrous times. The Chinese are just as clever as the Japanese; they are wonderfully homogeneous; there are no class or race hatreds as in India. Waking up is slow, very slow, but it must come.

In such places as this letters are esteemed more than gold, more than tobacco—they are the only little joys we have. It is very hard to live in such places as this, and we only go through it by the aid of letters and a certain doggedness which is acquired by practice. Russian officers in similar stations in Siberia commit suicide at the rate of 5 per cent. annually, I have been told.

My kind regards to all, and best wishes.

Yours very truly,

(Signed) AUGUSTINE HENRY.

DCXXVIII.—INSECT POWDERS.

Recent inquiry has been made as to certain vegetable powders known as Persian and Dalmatian Insect Powders. As references to these are scattered through works not usually accessible, a brief summary is given.

There are two plants employed. What is known as Caucasian or Persian insect powder is obtained from the flower-heads of *Chrysanthemum roseum*, Adam (Pyrethrum roseum, *Bieb.*), with rosy flowers, a native of the Caucasus, where it grows on mountain slopes at a high elevation.

Dalmatian insect powder, usually regarded as the more effective, is derived from *Chrysanthemum cinerariæfolium*, Visiani (Pyrethrum cinerariæfolium, *Trev.*), *Bot. Mag.*, t. 6781, with white flowers, a native of Dalmatia.

A full account of these plants (where, however, they are referred to as species of *Pyrethrum*), their cultivation and uses, is given in the *Fourth Report of the U.S. Entomological Commission*, 1885, pp. 164–180. From this Report the following extracts are taken:—

HISTORY.

"There are very few data at hand concerning the discovery of the insectide properties of Pyrethrum. The powder has been in use for many years in Asiatic countries south of the Caucasus Mountains. It was sold at a high price by the inhabitants, who successfully kept its nature a secret until the beginning of this century, when an Armenian merchant, Mr. Jumtikoff, learned that the powder was obtained from the dried and pulverized flower-heads of certain species of *Pyrethrum* growing abundantly in the mountain region of what is now known as the Russian province of Transcaucasia. The son of Mr. Jumtikoff began the manufacture of the article on a large scale in 1828, after which year the Pyrethrum industry steadily grew, until to-day the export of the dried flower-heads represents an important item in the revenue of those countries.

"Still less seems to be known of the discovery and history of the Dalmatian species of Pyrethrum (*Pyrethrum cinerariæfolium*), but it is probable that its history is very similar to that of the Asiatic species. At the present time the Pyrethrum flowers are considered by far the most valuable product of the soil of Dalmatia." (Pp. 164–165.)

Cultivation.

"There is also very little information published regarding either the mode of growth or the cultivation of Pyrethrum plants in their native home. As to the Caucasian species, we have reason to believe that they are not cultivated, at least not at the present time, statements to the contrary notwithstanding. Dr. Gustav Radde, Director of the Imperial Museum of Natural History at Tiflis, Transcaucasia, who is the highest living authority on everything pertaining to the natural history of that region, wrote us recently as follows:—'The only species of its genus, *Pyrethrum roseum*, which gives a good effective insect powder, is nowhere cultivated, but grows wild in the basal-alpine zone of our mountains at an altitude of from 6,000 to 8,000 feet.' From this, it appears that this species at least is not cultivated in its native home, and Dr. Radde's statement is corroborated by a communication of Mr. S. M. Hutton, Vice-Consul General of the United States at Moscow, Russia, to whom we applied for seed of this species. He writes that his agents were not able to get more than about half a pound of the seed from any one person. From this statement it may be inferred that the seeds have to be gathered from the wild, and not from the cultivated plants.

"As to the Dalmatian plant, it is also said to be cultivated in its native home, but we can get no definite information, owing to the fact that the inhabitants are very unwilling to give any information regarding a plant, the product of which they wish to monopolize. For similar reasons we have found great difficulty in obtaining even small quantities of the seed of *P. cinerariæfolium* that was not baked, or in other ways tampered with, to prevent germination. Indeed, the people are so jealous of their plant that to send the seed out of the country becomes a serious matter, in which life is risked." (P. 165.)

Cultivation of C. roseum in France.

"In 1856, Mr. C. Willemot made a serious attempt to introduce and cultivate the plant on a large scale in France. As his account of the cultivation of Pyrethrum is the best we know of, we quote here his experience, with but few slight omissions: 'The soil best adapted to its culture should be somewhat siliceous and dry. Moisture, and the presence of clay is injurious, the plant being extremely sensitive to an excess of water, and would in such cases immediately perish. A southern exposure is the most favourable. The best time for putting the seeds in the ground is from March to April. It can be done even in the month of February, if the weather will permit it. After the soil has been prepared and the seeds are sown, they are covered by a layer of

earth mixed with vegetable mould, when the roller is slightly applied to it. Every five or six days the watering is to be renewed in order to facilitate the germination. At the end of about thirty or forty days the young plants make their appearance, and as soon as they have gained strength enough they are transplanted at a distance of about six inches from each other. Three months after this operation they are transplanted again at a distance of from fourteen to twenty inches, according to their strength. Each transplantation requires, of course, a new watering, which, however, should be only moderately applied. The blossoming of the Pyrethrum commences the second year, toward the end of May, and continues to the end of September. Mr. Willemot also states that the plant is very little sensitive to cold, and needs no shelter, even during severe winters.' " (Pp. 165–166.)

Cultivation of C. cinerariæfolium in California.

"As to the Dalmatian plant, it is well known that Mr. G. N. Milco, a native of Dalmatia, has of late years successfully cultivated *Pyrethrum cinerariæfolium* near Stockton, California, and the powder from the California-grown plants, to which Mr. Milco has given the name of 'Buhach,' retains all the insecticide qualities, and is far superior to most of the imported powder, as we know from experience. Mr. Milco gives the following advice about planting—advice which applies more particularly to the Pacific Coast :—'Prepare a small bed of fine, loose, sandy, loamy soil, slightly mixed with fine manure. Mix the seed with dry sand and sow carefully on top of the bed. Then with a common rake disturb the surface of the ground half an inch in depth. Sprinkle the bed every evening until sprouted; too much water will cause injury. After it is well sprouted, watering twice a week is sufficent. When about a month old weed carefully. They should be transplanted to loamy soil during the rainy season of winter or spring.' " (P. 166.)

Cultivation in Victoria.

According to a Melbourne agricultural paper, quoted in the Cape *Agricultural Journal* of June 5th, 1890, "Mr. Kleesattel has now six acres under Pyrethrum, and the portion first planted has commenced to yield a return. In establishing his plantation the land was ploughed 12 inches deep, and the soil reduced to a fine tilth. The seed is sown in beds in the month of August, and the following winter the young plants are transplanted out in rows 2 feet 6 inches apart, there being a space of about 1 foot between the plants. The crop is kept clean by the use of the horse hoe, and in the following November, *i.e.*, fifteen months from when the seed was sown, the plants begin to flower. This is, of course, the harvest season for the Pyrethrum, and the plants continue to bloom till the end of January. The picking operation was at first rather expensive, but a stripping machine has been designed that does the work of collecting the flowers very well. When picked the flowers are kiln-dried, and then ground into powder. As the plant is a perennial the crops will last for several years without the expense of re-planting. The powder, which is of a saffron colour, has been tested, and found superior to the imported article."

Preparation of the Plants for use.

The United States Report continues : "In regard to manufacturing the powder, the flower-heads should be gathered during fine weather, when they are about to open, or at the time when fertilization takes place, as the essential oil that gives the insecticide qualities reaches, at this time, its greatest development. When the blossoming has ceased, the stalks may be cut within about four inches from the ground and utilized, being ground and mixed with the flowers in the proportion of one-third of their weight. Great care must be taken not to expose the flowers to moisture, or the rays of the sun, or still less to artificial heat. They should be dried under cover, and hermetically closed up in sacks or other vessels to prevent untimely pulverization. The finer the flower-heads are pulverized, the more effectually the powder acts, and the more economical is its use. Proper pulverization in large quantities is best done by those who make a business of it, and have special mill facilities. Lehn & Fink, of New York, have furnished us with the most satisfactory powder. For his own use, the farmer can pulverize smaller quantities by the simple method of pounding the flowers in a mortar. It is necessary that the mortar be closed, and a piece of leather through which the pestle moves, such as is generally used in pulverizing pharmaceutic substances in a laboratory, will answer. The quantity to be pulverized should not exceed one pound at a time, thus avoiding too high a degree of heat, which would be injurious to the quality of the powder. The pulverization being deemed sufficient, the substance is sifted through a silk sieve, and then the remainder, with a new addition of flowers, is put in the mortar and pulverized again.

"The best vessels for keeping the powder are fruit jars with patent covers, or any other perfectly tight glass vessel or tin box." (Pp. 167–168).

Advantages and Disadvantages.

In the *Botanical Magazine*, t. 6781, the following conclusions are given respecting the efficacy of these insect powders :—

"It appears that the powder of both species is valuable as a general insecticide, especially in a liquid solution, but that it is not a universal remedy, and has serious disadvantages. Of the advantages the most notable is that it is a specific in the case of aphides, house flies, and mosquitoes (or gnats), and if used with a pair of ordinary bellows is very effectual in killing the commoner insects that infest plants in rooms or houses. The powder burnt is not disagreeable to smell, and very effectual in rooms, wardrobes, and greenhouses. The alcoholic extract of the powder diluted in water, the simple solution in water, and the decoction in water, are all most useful in cases where the powder may be less effectually applied. The disadvantages are that the result is not permanent ; after half an hour insects may re-appear on the plants that had been cleared, and be unhurt. Again, actual contact with the insect is necessary in the open air, and powdering the upper side of a leaf has no effect on an insect on the under side. More important still are the facts that it has no

effect on insects' eggs or hard chrysalises, on beetles with hard elytra, and on the vast class of hemiptera (true bugs), whilst hairy caterpillars and spiders of all kinds are proof against it. Hymenoptera, however, quickly succumb to its effects."

Active Principle.

The active principle of Pyrethrum flowers has been examined by Messrs. Schlagdenhauffen and Reeb. An account of their research is given in the *Pharmaceutical Journal* (July 26, 1890, p. 63). It is an acid soluble in alcohol, amylic alcohol, ether, and chloroform, which may be isolated by means of ether after having been converted into an alkaline salt, and decomposed by tartaric acid in aqueous solution.

When pyrethrotoxic acid was hypodermically injected into animals, it was observed that the poison produced its effects in two distinct stages. In the first there was an excitement more or less pronounced, proportional to the quantity administered; in the second there was a complete prostration, accompanied always by paralysis of the lower extremities, which might disappear after a time, or be the precursor of a fatal issue, the respiration and circulation being affected only in the latter case.

DCXXIX.—DIAGNOSES AFRICANÆ, XII.

669. **Psorospermum membranaceum,** *C. H. Wright* [Hypericaceæ]; ad *P. tenuifolium*, Hook. fil., accedit, sed foliis membranaceis et nervis secundariis paucioribus differt.

Frutex 6–8-pedalis. *Rami* castanei, nitidi. *Folia* breviter petiolata, ovata, acuminata, irregulariter crenata, basi acuta, 4–5 poll. longa, 2½ poll. lata, nigro-punctata; nervi secundarii utrinque 4–5. *Cymæ* contractæ, 6–8-floræ. *Sepala* ovato-lanceolata, acuta, glabra, nigro-lineata. *Petala* ovata, obtusa, nigro-lineata, intus prope apicem pilosa, 4 lin. longa, 2½ lin. lata. *Disci* glandulæ 5, breviter bilobatæ. *Staminum* filamenta 4–6-na connata, pilosa; antheræ globosæ. *Ovarium* conicum; styli clavati, staminibus paullo longiores.

French Congo. Angoni, 70 miles east of Gaboon, *Bates*, 559.

670. **Dombeya Johnstonii,** *Baker* [Sterculiaceæ]; ad *D. schimperianam*, A. Rich., abyssinicam, magis accedit.

Ramuli lignosi, validi, pilis brevibus mollibus pallide brunneis dense persistenter vestiti. *Folia* cordato-orbicularia, 6–7 poll. longa, crenata, integra vel obscure 3–5-lobata, utrinque dense pubescentia, lobis basalibus vel magnis imbricatis vel minoribus sinu basali aperto; petioli 3–8 poll. longi. *Umbellæ* simplices, densæ, multifloræ, 3½–4 poll. diam.; pedunculi axillares, 2–4 poll. longi; pedicelli pubescentes, flore longiores, primum cernui; bracteolæ oblongæ, acutæ, calyce paullo breviores. *Sepala* lanceolata, 8–9 lin. longa, dorso dense pubescentia, flore expanso reflexa. *Petala* cuneata, valde imbricata, rosea, calyce vix longiora,

persistentia, demum scariosa. *Stamina* basi in cupulam ovario æquilongam coalita ; staminodia 5, ligulata, petalis paullo breviora. *Ovarium* globosum, dense pilosum ; styli 5, elongati, pubescentes, apice falcati.

British Central Africa. Between Mpata and the beginning of the Tanganyika plateau, alt. 2000–3000 feet, and Nyika plateau, alt. 6000–7000 ft., *Whyte.*

671. **Geranium Whytei**, *Baker* [Geraniaceæ] ; ad *G. tuberosum*, Linn., europæum habitu et foliis accedit ; differt radice elongata fusiformi haud tuberosa, petalis angustioribus.

Herba perennis, radice dura, fusiformi. *Folia* radicalia multa, longe petiolata, ad basin dissecta, 1–1½ poll. longa, leviter pubescentia, segmentis profunde pinnatifidis, lobis paucis ascendentibus linearibus uninerviis, superiora reducta. *Caulis* gracilis, pubescens, erectus, subpedalis, foliis paucis præditus. *Pedunculi* pauci, ascendentes, biflori ; bracteæ parvæ, lanceolatæ, scariosae ; pedicelli elongati, ascendentes, pubescentes. *Sepala* lanceolata, pubescentia, 4 lin. longa. *Petala* oblanceolata, obtusa, rubella, 6 lin. longa. *Stamina* calyci æquilonga, filamentis pubescentibus. *Carpella* 5, dense pilosa, rostris elongatis pubescentibus.

British Central Africa. Mount Malosa and Mount Zomba, alt. 4000–6000 ft., *Whyte.*

Differs greatly from any Tropical African species already known.

672. **Phylica tropica**, *Baker* [Rhamnaceæ] ; ad *P. stipularem*, Linn., capensem habitu et foliis accedit ; differt defectu stipularum.

Frutex erectus, ramulis multis erectis ascendentibus lignosis albo-incanis ad apicem crebre foliatis. *Folia* sessilia, lanceolata, 5–6 lin. longa, integra, mucronata, rigide coriacea, exstipulata, facie atroviridia nitida glabra, margine recurvata, dorso albo-incana. *Capitula* sessilia, terminalia, pauciflora, dense pilosa. *Calyx* parvus, campanulatus, persistens, segmentis 5 lanceolatis recurvatis. *Ovarium* globosum, pilosum, brevissime pedicellatum. *Fructus* globosus, durus, niger, indehiscens, glabrescens, 2 lin. diam.

British Central Africa. Nyasaland ; South Nyika Mountains, alt. 4000–7000 ft., *Whyte.*

672.* **Vitis (Cissus) zombensis**, *Baker* [Ampelidaceæ]. This name is substituted for *V. apodophylla*, Baker (*Kew Bulletin*, 1897, p. 248), which had already been applied to another species (*l. c.* 1894, p. 330).

673. **Virecta salicoides**, *C. H. Wright* [Rubiaceæ-Hedyotideæ] ; ad *V. angustifoliam*, Hiern, accedit, sed major, foliis acutis et staminibus longe exsertis.

Caulis lignosus, teres, lineis duabus pubescentibus oppositis ornatus. *Folia* lanceolata, basi apiceque acuta, supra ad nervos appresse hirsuta, 1½–2 poll. longa, 4 lin. lata ; stipulæ alte 2–4-partitæ. *Flores* ad ramulorum apices cymoso-corymbosi, 1 poll.

longi, 6–7-meri. *Calycis* lobi quam corollæ tubus breviores, subulati. *Corollæ* tubus infundibuliformis, 7 lin. longus, apice 2½ lin. diam. ; lobi subulati, 5 lin. longi. *Stamina* quam corollæ lobi paullo longiora ; filamenta filiformia ; antheræ oblongæ, versatiles. *Stylus* exsertus, 12 lin. longus.

FRENCH CONGO. Mfoa, 85 miles east of Gaboon, *Bates*, 527.

673.* **Senecio subpetitianus**, *Baker* [Compositæ-Senecionideæ]. This name is proposed for *S. nyikensis*, Baker (*Kew Bulletin*, 1898, p. 154), which was already occupied (*l. c.* 1897, p. 271).

674. **Carpodinus congolensis**, *Stapf* [Apocynaceæ] ; affinis *C. unifloræ*, Stapf, sed foliis minoribus latioribus tenuioribus, bracteis calycis segmentis multo minoribus et ab his magis diversis, corollæ tubo multo tenuiore distincta.

Frutex scandens, ecirrhosus, glaberrimus. *Folia* oblonga vel elliptica, 4–5 poll. longa, 1½–2 lin. lata, abrupte acuminata, acumine lineari 2–4 lin. longo, papyracea, læte viridia, nervis utrinque 5–6 ; petiolus gracilis, 2–4 lin. longus. *Flores* axillares, solitarii : bracteæ minutæ. *Calyx* 1–1¼ lin. longus, segmentis late ovatis obtusis ciliolatis. *Corollæ* tubus gracillimus, sub fauce ampliatus, 9–10 lin. longus, extus glaber, lobos lineares aequans. *Ovarium stylusque* pubescens.

CONGO FREE STATE. Lower Congo, Bingila, *Dupuis*.

675. **Carpodinus gracilis**, *Stapf* [Apocynaceæ] ; affinis *C. ligustrifoliæ*, Stapf, sed foliis minoribus tenuioribus plus minusve pilosulis, cymis 2–3-floris laxis vel ad florem solitarium pedunculo gracili suffultum redactis distincta.

Fruticulus, ramis gracilibus glabris vel sparse pilosulis nonnullis in cirrhos gracillimos transmutatis. *Folia* ovato-oblonga vel ovato-lanceolata, sensim obtuse acuminata, basi rotundata, 1¾–2½ poll. longa, 7–12 lin. lata, tenuiter coriacea, subtus parce pilosula, glabrescentia, nervis secundariis utrinque circiter 12 patulis cum tertiariis et venis tenuibus vel tenuissimis. *Cymæ* axillares vel terminales, 3–2-flores vel ad florem solitarium redactæ ; pedunculus et cymæ ramuli gracillimi, ille 4–12 lin., hi 1–3 lin. longi, pilosuli ; bracteæ minutæ, rufo-pilosulæ. *Calycis* segmenta ovata, subobtusa, vix 1 lin. longa, minutissime parceque pilosula, ciliolata. *Corollæ* gracilis tubus 8 lin. longus, sub fauce sensim ampliatus ; lobi lineares, acuti, circiter 8 lin. longi. *Ovarium* basi subconstrictum, glabrum ; stylus gracillimus, 6–7 lin. longus, glaber. *Fructus* ellipsodieus vel subglobosus, basi truncatus, 1½–1¾ poll. longus.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 516 ; very common between Kimwoenza and Léopoldville, *Laurent*.

676. **Carpodinus leptantha**, *Stapf* [Apocynaceæ] ; affinis *C. parvifloræ*, Stapf, sed foliis minoribus oblongis abrupte longeque acuminatis, nervis subhorizontalibus crebrioribus, floribus gracilioribus diversa.

Frutex scandens, cirrhosus, ramis gracilibus glaberrimis. *Folia* oblonga vel elliptico-oblonga, abrupte longeque acuminata, basi

rotundata, $2\frac{1}{2}$–3 poll. longa, 1–$1\frac{1}{3}$ lin. lata, coriacea, glaberrima, nervis secundariis subhorizontalibus 3–5 lin. distantibus cum tertiariis vix tenuioribus parallelis utrinque prominulis. *Flores* axillares, solitarii, sparsi, subsessiles; bracteæ minutæ, tenuissime rufo-tomentellæ. *Calycis* segmenta ovata, subacuta, vix 1 lin. longa, parce et minutissime puberula, ciliolata. *Corollæ* viridi-flavescentis tubus pertenuis, sub fauce leviter ampliatus, 4 lin. longus; lobi anguste lineares, filiformiter contorti, ad 3 lin. longi. *Ovarium* tenuiter crispo-puberulum; stylus tenuissimus, $1\frac{1}{2}$ lin. longus, superne glaber. *Fructus* globosus, 10 lin. dimetiens.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 590.

677. **Carpodinus ligustrifolia,** *Stapf* [Apocynaceæ]; affinis *C. turbinatæ*, Stapf, sed foliis oblongo-lanceolatis sensim et longius acuminatis subtus tenuiter nervosis diversa.

Frutex scandens, imo apice interdum rufo-tomentello excepto glaber. *Folia* ovato- vel oblongo-lanceolata, sensim longiuscule obtuse acuminata, basi rotundata, 2–$3\frac{1}{2}$ poll. longa, 9–14 lin. lata, coriacea, nervis secundariis utrinque 7–8 tenuibus; petiolus gracilis, 1–$1\frac{1}{2}$ lin. longus. *Flores* axillares, raro in ramulo uno alterove terminales, solitarii, subsessiles; bracteæ minutæ, tenuissime rufo-puberulæ. *Calycis* segmenta ovata, subobtusa, vix 1 lin. longa, ciliolata, cæterum glabra. *Corollæ* glabræ albæ tubus gracilis, 8–9 lin. longus, sub fauce paullo ampliatus; lobi lineares, acuti, circiter 1 poll. longi, $1\frac{1}{2}$ lin. lati. *Ovarium* basi constricta glabra excepta tomentellum; stylus tenuis, 6–7 lin. longus, superne glabrescens.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 709.

678. **Carpodinus turbinata,** *Stapf* [Apocynaceæ]; affinis *C. Barteri*, Stapf, sed glabritie, foliis oblongis distinctius acuminatis subtus prominenter reticulatis, floribus solitariis majoribus distincta.

Frutex scandens, ecirrhosus, glaber. *Folia* oblonga, breviter obtuseque acuminata, basi subrotunda, $2\frac{1}{2}$–$3\frac{1}{4}$ poll. longa, 12–16 lin. lata, coriacea, pallida, nervis secundariis utrinque 7–9 cum venis reticulatim anastomosantibus subtus prominulis; petiolus $2\frac{1}{2}$–$3\frac{1}{2}$ lin. longus. *Flores* axillares, raro in ramulo uno alterove terminales, solitarii, subsessiles; bracteæ minutæ, puberulæ. *Calycis* segmenta ovata, obtusa, 1–$1\frac{1}{4}$ lin. longa, glabra, minutissime ciliolata. *Corollæ* glabræ tubus gracilis, 10–12 lin. longus, sub fauce ampliatus; lobi anguste lineares, 9–12 lin. longi, 1 lin. lati. *Ovarium* basi glabra excepta villosulum; stylus 7–9 lin. longus, villosulus. *Fructus* late conico-pyramidatus, fere 3 poll. longus, basi truncatus.

CONGO FREE STATE. Lower Congo, *Dewèvre*.

679. **Pleiocarpa tubicina,** *Stapf* [Apocynaceæ]; affinis *P. bicarpellatæ*, Stapf, sed foliis verticillatis longius petiolatis, floribus numerosis minoribus in glomerulis collectis, corollæ lobis admodum brevibus distincta.

Frutex glaberrimus. *Folia* ternata, oblonga, breviter et plerumque obtuse acuminata, basi acuta, $3\frac{1}{2}$–$4\frac{1}{4}$ poll. longa

1–1½ poll. lata, coriacea, supra lucida, nervis numerosis tenuibus patulis cum venis supra prominulis; petiolus 6–8 lin. longus. *Cymæ* glomeruliformes, multifloræ. *Calyx* glaber, alboviridis, ¾–⅘ lin. longus, segmentis oblongis obtusis. *Corolla* flavido-alba; tubus cylindricus, 3½ lin. longus; lobi ovati, obtusi, ¾ lin. longi. *Antheræ* sub fauce insertæ, ⅜ lin. longæ. *Ovarii* carpella 2, utrinque 2-ovulata; stylus tenuissimus, 2 lin. longus.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 945.

680. **Tabernanthe albiflora**, *Stapf* [Apocynaceæ]; affinis *T. Ibogæ*, Baill., sed floribus albis roseo-punctatis minoribus, tubo corollino fere cylindrico diversa.

Frutex glaberrimus. *Folia* oblonga, utrinque acuminata vel basi acuta (acumine subacuto vel obtuso, 3–7 lin. longo), 3–5 poll. longa, 1–1⅔ poll. lata, tenuia, nervis utrinque 6–9; petiolus tenuis, 1–3 lin. longus. *Cymæ* longe pedunculatæ, laxæ, paucifloræ, foliis breviores; pedunculus gracilis, ½–1½ poll. longus; pedicelli inæquales, ad 3 lin. longi. *Calyx* ¾ lin. longus, in fructu persistens, reflexus, segmentis rotundato-ovatis minutissime ciliolatis, interioribus basi 1–2 glandulosis. *Corolla* alba, roseo-punctata; tubus subcylindricus, basi subdilatatus, 2½ lin. longus: lobi obovati, 1½ lin. longi. *Stamina* medio inserta; antheræ fauces attingentes. *Ovarium* globoso-ovoideum, glabrum, multiovulatum. *Fructus* citriformis, stylo persistente coronatus, subpollicaris, pericarpio levi subcoriaceo; semina verrucosa, 2½ lin. longa, ut videtur in pulpa nidulantia.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 684.

681. **Tabernanthe tenuiflora**, *Stapf* [Apocynaceæ]; affinis *T. Ibogæ*, Baill., sed cymis gracillimis, floribus minoribus, foliis firmioribus diversa.

Frutex glaberrimus. *Folia* late oblanceolata, unum plerumque subsessile vel sessile basi plus minusve rotundatum, alterum ejusdem paris breviter petiolatum et basi acutum vel subacutum, omnia acuminata, æqualia vel unum sæpe altero minus, majora 4–6 poll. longa, 1¼–2 poll. lata tenuia nervis utrinque 8–10. *Cymæ* gracillime pedunculatæ, laxæ, paucifloræ; petiolus ¾–1 poll. longus; pedicelli ad 3 lin. longi. *Calyx* ¾ lin. longus, segmentis rotundatis parce et minute ciliolatis, interioribus basi intus 1–2-glandulosis. *Corollæ* flavescentis tubus e basi ovoidea cylindricus, 2 lin. longus; lobi late obovati, tubo breviores. *Stamina* medio inserta; antheræ fauces attingentes. *Discus* subnullus.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 361.

682. **Tabernæmontana Smithii**, *Stapf* [Apocynaceæ]; affinis *T. contortæ*, Stapf, et *T. durissimæ*, Stapf, a priore calyce paullo minore, corollæ tubo recto, lobis multi minoribus, ab altero corollis majoribus, tubo latiore, antheris longioribus differt.

Arbor parva, glaberrima, ramulis crassis. *Folia* elliptica vel oblonga, obtusissima, basi subacuta, 7–12 poll. longa, 4½–8 poll. lata, coriacea, nervis utrinque 11–14; petiolus 3–9 lin. longus,

robustus. *Cymæ* robustæ, basi dichotomæ, corymbosæ; pedunculus robustus, ad 6 poll. longus. *Calycis* segmenta late elliptica, $3\frac{1}{4}$–4 lin. longa, obtusissima, minute ciliolata, basi multiglandulosa. *Corollæ* albæ tubus basi leviter tortus, $2\frac{1}{4}$ poll. longus, medio 2 lin. latus; lobi oblongi, obtusi, circiter 1 poll. longi, 4 lin. lati. *Stamina* 7 lin. supra basin tubi inserta; antheræ 6 lin. longæ. *Stylus* 5–6 lin. longus. *Folliculi* 2, globosi.

CONGO FREE STATE. Lower Congo, *Chr. Smith*, *Dewèvre*, 261; near Léopoldville and Sankuru, *Laurent*.

683. **Tabernæmontana Thonneri,** *Durand et De Wildeman Mscr. ex Stapf* [Apocynaceæ]; affinis *T. durissimæ*, Stapf, sed fruticosus, foliis majoribus latioribus, nervis numerosioribus, corollæ tubo et imprimis lobis brevioribus.

Frutex circiter 15 ped. altus, glaberrimus, ramulis crassis. *Folia* elliptica vel obovato-oblonga, obtusissima, apiculata, basi subacuta vel rotunda, 8–12 poll. longa, $4\frac{1}{2}$–8 poll. lata, coriacea, nervis utrinque 11–12; petiolus ad 1 poll. longus. *Cymæ* robustæ, basi dichotomæ, submultifloræ, 2–$2\frac{1}{2}$ poll. longæ; pedunculus robustus, 3–$4\frac{1}{2}$ poll. longus; pedicelli crassi, ad 6 lin. longi. *Calycis* segmenta elliptica, obtusissima, $2\frac{1}{4}$–$2\frac{3}{4}$ lin. longa, minute ciliolata, basi multiglandulosa. *Corollæ* albæ odoratæ tubus ima basi tortus, $2\frac{1}{4}$ poll. longus, medio vix $1\frac{1}{2}$ lin. latus; lobi oblongi, obtusi, 12–15 lin. longi, $3\frac{1}{2}$–4 lin. lati. *Stamina* 4 lin. supra basin tubi inserta; antheræ fere 5 lin. longæ. *Stylus* 3–$3\frac{1}{2}$ lin. longus.

CONGO FREE STATE. Lower Congo, Bogolo, near Businga, on the margins of woods, 300 ft., *Thonner*, 109.

684. **Holarrhena congolensis,** *Stapf* [Apocynaceæ]; affinis *H. febrifugæ*, Klotzsch, sed calycis segmentis lanceolatis multo brevioribus, corollæ lobis paullo majoribus diversa.

Arbusculus 6–12 ped. altus, ramis juvenilibus imo apice hic inde minute puberulis cæterum glabris. *Folia* elliptico-oblonga, abrupte breviterque vel obscure acuminata, basi rotundata, 3–4 poll. longa, $1\frac{1}{2}$–2 poll. lata, subtenuia, glabra vel secundum costam minute puberula, nervis utrinque 7–9; petiolus 3–4 lin. longus. *Cymæ* multifloræ, specie laterales, sessiles in ramis foliatis hornotinis, parce et minutissime fulvo-puberulæ; pedicelli graciles 1–3 lin. longi. *Calycis* segmenta lanceolata, acuta, 1–$1\frac{1}{2}$ lin. longa, minute ciliolata. *Corollæ* tubus tenuis, 6 lin. longus, minutissime puberulus; lobi oblongi, obtusi, 8–9 lin. longi. *Stamina* paullo supra basin inserta; antheræ vix 1 lin. longæ. *Ovarium* glabrum.

CONGO FREE STATE. Lower Congo, near Boma Lundi, in Savannahs, *Cabra*.

685. **Isonema infundibuliflorum,** *Stapf* [Apocynaceæ]; affine *I. Smeathmannii*, Roem. *et* Schult., foliis majoribus distinctius acutiusque acuminatis longius petiolatis, corollæ tubo infundibuliformi latiusculo diversum.

Rami teretes, novelli rufo- vel fulvo-tomentelli, deinde glabrati, nigrescentes. *Folia* oblonga, longiuscule acuteque acuminata, basi rotundata, 3–$4\frac{1}{2}$ poll. longa, $1\frac{1}{3}$–2 poll. lata (infima ramorum multo minora), coriacea, supra glabra, inferne ad nervos hirsutiuscula,

nervis secundariis utrinque circiter 6, venis supra prominulis laxe anastomosantibus infra inconspicuis; petiolus hispidulus, $2\frac{1}{2}$–3 lin. longus. *Panicula* terminalis, brevis, 1–$1\frac{1}{2}$ poll. longa, rufo- vel fulvo-tomentella, pedunculo $\frac{1}{2}$ poll. longo suffulta; rami inferiores $\frac{1}{2}$–$\frac{3}{4}$ poll. longi, cymas 3–4-floras gerentes, superiores breviores simpliciores; bracteæ minutæ, caducæ; pedicelli ad $2\frac{1}{2}$ lin. longi. *Calyx* $1\frac{1}{2}$ lin. longus, puberulus, segmentis ovatis acuminatis intus basi glandulis subulatis brevibus munitis. *Corolla* rubra, extus tenuissime tomentella; tubus infundibuliformis, 4 lin. longus; lobi admodum asymetrici, 3 lin. longi. *Staminum* conus $3\frac{1}{2}$ lin. longus, ultra medium exsertus; filamenta in juga intus valde prominentia, albo-hirsuta, decurrentia. *Ovarium* apice rufo-pilosum.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 554.

686. **Alafia major,** *Stapf* [Apocynaceæ]; admodum affinis *A. Barteri*, Oliv., foliorum nervis remotioribus, panicula breviter pedunculata, pedicellis longioribus, corollis majoribus distincta.

Frutex scandens, glaberrimus. *Folia* late oblonga vel obovata, obtusissima vel obscure obtuseque acuminata, basi subacuta, 4–5 poll. longa, $2\frac{1}{2}$ poll. lata, subcoriacea, supra lucida, nervis utrinque 5–6 distantibus $\frac{1}{2}$–$\frac{3}{4}$ poll., venis laxis subtus prominulis; petiolus $1\frac{1}{2}$–3 lin. longus. *Panicula* multiflora, densa, foliis summis multo brevior; pedunculus $\frac{1}{3}$ poll. longus; pedicelli ad 4 lin. longi. *Calyx* $\frac{3}{4}$ lin. longus, segmentis ovatis subobtusis. *Corollæ* albæ tubus cylindricus, medio subinflatus, $2\frac{1}{2}$ lin. longus, extus tenuissime puberulus; lobi lati, oblique truncato-obovati, 6 lin. longi, papillosi. *Antheræ* apice subexsertæ.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 673.

687. **Oncinotis tenuiloba,** *Stapf* [Apocynaceæ]; affinis *O. gracili*, Stapf, sed foliis tenuioribus obliquius nervosis, panicula graciliore, pedicellis longioribus, corollæ lobis multo angustioribus diversa.

Frutex inflorescentia et ramis novellis minutissime tomentellis exceptis glaber. *Folia* lanceolato-oblonga, acute acuminata, basi acuta, circiter 3 poll. longa, 1 poll. lata, tenuiter coriacea, nervis utrinque 5 valde obliquis, venis transversis laxis; petiolus tenuis, 2–3 lin. longus. *Paniculæ* $1\frac{1}{2}$–2 poll. longæ, graciles; pedicelli $1\frac{1}{2}$ lin. longi. *Calyx* $\frac{3}{4}$ lin. longus, segmentis ovato-oblongis puberulis intus eglandulosis. *Corolla* viridi-flavescens, extus tenuissime tomentellus; tubus breviter cylindricus, fere $1\frac{1}{2}$ lin. longus; lobi quam tubus duplo longiores, patentes, angustissime lineares; squamæ fauciales lineares, obtusæ, fere $\frac{1}{2}$ lin. longæ. *Antheræ* $\frac{1}{2}$ lin. longæ. *Discus* subinteger.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 883.

688. **Kickxia latifolia,** *Stapf* [Apocynaceæ]; affinis *K. africanæ*, Benth., sed foliis latioribus basi rotundatis, corollis albis, lobis multo brevioribus diversa.

Arbor glaberrima. *Folia* oblonga vel elliptica, acuminata, basi rotundata, 6–7 poll. longa, $2\frac{1}{2}$–4 poll. lata, coriacea, nervis utrinque 10–12 subrectis; petiolus crassus, 4–5 lin. longus. *Cymæ* congestæ, multifloræ, breviter pedunculatæ; pedicelli 1–2 lin. longi.

Calycis segmenta ovata, subacuta vel obtusa, crassiuscula, $1\frac{1}{4}$–$1\frac{1}{2}$ lin. longa, minutissime ciliolata, intus basi biglandulosa. *Corolla* carnosula, alba, alabastro ad 6 lin. longa; tubus parce et minutissime puberulus, medio dilatatus, $3\frac{1}{4}$–4 lin. longus; lobi oblongi, obtusi, $2\frac{1}{2}$–3 lin. longi. *Antheræ* fauces attingentes, 1 lin. paullo longiores. *Discus* crassiusculus, 5-lobus.

CONGO FREE STATE. Lower Congo, *Dewèvre*, 867.

689. **Secamone Whytei**, *N. E. Brown* [Asclepiadaceæ]; affinis *S. Stuhlmannii*, K. Schum., sed pedicellis longioribus facile distincta.

Caules volubiles, juniores ferrugineo-pubescentes. *Folia* $1\frac{1}{4}$–$2\frac{1}{2}$ poll. longa, $4\frac{1}{2}$–10 lin. lata, lanceolata, acuta, juniora ferrugineo-pubescentia, demum supra vel utrinque glabra. *Cymæ* corymbosæ, plurifloræ, ferrugineo-pubescentes. *Pedicelli* 3–4 lin. longi. *Sepala* $\frac{2}{3}$ lin. longa, $\frac{1}{2}$ lin. lata, elliptico-oblonga vel ovato-oblonga, obtusa. *Corolla* 2 lin. diam., glabra; lobi oblongi, obtusi. *Coronæ* lobi falcato-subulati. *Styli* apex ultra antheras exsertus, globosus, minute pubescens.

BRITISH CENTRAL AFRICA. Nyasaland; Mount Malosa, 4000–6000 ft., *Whyte.*

690. **Asclepias Nuttii**, *N. E. Brown* [Asclepiadaceæ]; proxima *A. amabili*, N. E. Br., sed corona exacte truncata edentata facile distincta.

Caulis simplex, 1–$1\frac{1}{2}$ ped. altus, gracilis, glaber. *Folia* erecta, $1\frac{1}{2}$–$2\frac{3}{4}$ poll. longa, $\frac{1}{2}$–1 lin. lata, linearia, acuta, glabra, marginibus minute scaberulo-ciliata. *Umbella* terminalis, pedunculata, 8–10-flora. *Pedicelli* 4–5 lin. longi, minute pubescentes. *Sepala* 2 lin. longa, $\frac{1}{2}$ lin. lata, lanceolata, acuminata, minute pubescentia. *Corollæ* lobi 4 lin. longi, $1\frac{1}{2}$ lin. lati, oblongo-lanceolati, subacuti, glabri. *Coronæ* lobi $1\frac{1}{2}$ lin. longi, erecti, cucullati, truncati, edentati, intra nudi.

GERMAN EAST AFRICA. Between Lake Tanganyika and Lake Rukwa, 6000 ft., *Nutt.*

691. **Ceropegia papillata**, *N. E. Brown* [Asclepiadaceæ]; *C. leucotæniæ*, K. Schum., affinis, sed floribus multo majoribus differt.

Caules volubiles, pubescentes. *Folia* $1\frac{1}{4}$–$2\frac{1}{2}$ poll. longa, $\frac{1}{2}$–1 poll. lata, petiolata, elongato-ovata, acuminata, utrinque minute subtomentosa. *Cymæ* umbelliformes, 10–20-floræ, subsessiles. *Pedicelli* 4–5 lin. longi, pubescentes. Sepala 3 lin. longa, lineari-lanceolata, acuta, pubescentia. *Corollæ* tubus $\frac{3}{4}$ poll. longus, strictus, basi inflatus, glaber, intra basi papillatus; lobi 3 lin. longi, erecti, apice connati, lineares, replicati, intus villosi. *Coronæ* lobi exteriores $\frac{3}{4}$ lin. longi, erecti, lineares, apice bifidi; lobi interiores $\frac{2}{3}$–$\frac{3}{4}$ lin. longi, connivento-erecti, lineares.

BRITISH CENTRAL AFRICA. Nyasaland; Plateau of Mount Zomba, 5000–6000 ft., *Whyte.*

692. **Ceropegia Perrottetii**, *N. E. Brown* [Asclepiadaceæ]; affinis *C. beccarianæ*, Martelli, sed floribus racemosis differt.

Caulis volubilis, glaber. *Folia* 6–8 lin. longa, 5–6 lin. lata, ovata, acuta, apiculata, basi cordata vel subcordata, utrinque glabra. *Flores* in fasciculos 3–4-floros secus pedunculum 1–3 poll. longum racemosim dispositi. *Pedicelli* 3–4 lin. longi, glabri. *Sepala* $1\frac{1}{2}$ lin. longa, lanceolata, acuminata, glabra. *Corollæ* tubus 9 lin. longus, basi inflatus, fauce infundibuliformis, extra glaber; lobi 3 lin. longi, deltoideo-ovati, acuti, replicati, apice connati, glabri.

SENEGAL. *Perrottet*, 791.

693. **Ceropegia pumila**, *N. E. Brown* [Asclepiadaceæ]; affinis *C. pygmææ*, Schinz, sed floribus multo minoribus valde distincta.

Herba 4–6 poll. alta, ramosa, ramis plus minusve pubescentibus. *Folia* 6–11 lin. longa, $1\frac{1}{2}$–2 lin. lata, anguste lanceolata, acuta, ciliata. *Pedunculus* 0–$\frac{3}{4}$ lin. longus, 1–3-florus; pedicelli $1\frac{1}{2}$ lin. longi. *Corolla* circa 6 lin. longa, curvata, extra pubescens, intra glabra, fusco-purpurea vel atro-purpurea; tubus 4–5 lin. longus, ovoideo-inflatus, infra fauces breviter infundibuliformes valde constrictus; lobi $1\frac{1}{2}$ lin. longi, e basi deltoidea lineares, liberi.

ANGOLA. Huilla; near Lopollo, 2500 ft., *Welwitsch*, 4267.

694. **Ceropegia paricyma**, *N. E. Brown* [Asclepiadaceæ]; affinis *C. leucotæniæ*, K. Schum., sed sepalis minoribus et corolla multo majore differt.

Caulis volubilis, parce pubescens. *Folia* petiolata, 1–2 poll. longa, $\frac{1}{2}$–1 poll. lata, oblongo-ovata, obtuse-acuminata, basi cordata, utrinque parce pubescentia. *Cymæ* subsessiles, binæ, 4–6-floræ. *Pedicelli* 3–5 lin. longi, glabri. *Sepala* 1–$1\frac{1}{4}$ lin. longa, lanceolato-subulata, subglabra. *Corollæ* tubus rectus, 7–$7\frac{1}{2}$ lin. longus, basi inflatus, fusco-purpureus, superne angustatus, pallidus, fauce vix dilatatus; lobi $3\frac{1}{2}$ lin. longi, erecti, apicibus cohærentes, e basi deltoidea angulis reflexa lineari-spathulati, replicati, ciliati, basi subnigri, superne atrovirides.

BRITISH CENTRAL AFRICA. Lake Nyasa, *Simons*.

695. **Huernia somalica**, *N. E. Brown* [Asclepiadaceæ]; *H. oculatæ*, Hook. fil., affinis, sed corollæ lobis rugoso-papillatis differt.

Caules $2\frac{1}{2}$–3 poll. alti, pentagoni, glabri, angulis longe et acute dentati. *Pedicelli* 3–4 lin longi, glabri. *Sepala* 3 lin. longa, subulata, acuminata, glabra. *Corolla* $1\frac{1}{4}$–$1\frac{1}{2}$ poll. diam.; tubus campanulatus, utrinque glaber, intra fusco-purpureus; limbus recurvus, convexus, fusco-purpureus; lobi distantes, deltoidei, acuti, dentibus 5 parvis interjectis, extra glabri, intra papillosi, hebeti-ochracei. *Coronæ* lobi exteriores subquadrati, bifidi, sanguinei; lobi interiores conniventes, 1 lin. longi, subulati, lutei, supra purpureo-marginati.

SOMALILAND. *Mrs. Lort Phillips* (Cult. in horto cantabrigiensi).

696. **Moræa (Eumoræa) macrantha**, *Baker* [Iridaceæ]; ad *M. angustam*, Ker-Gawl., magis accedit.

Cormus magnus. *Folia* radicalia linearia, 1½–2 poll. longa, 9–12 lin. lata, glabra, chartacea, conspicue nervata. *Caulis* simplex, teres, bipedalis. *Spatha* cylindrica, 3–4 poll. longa, valvis rigidulis pallide viridibus, exteriore quam interiore conspicue breviore. *Ovarium* clavatum, 6–9 lin. longum. *Perianthium* saturate lilacinum, 2½ poll. longum, segmentis exterioribus obovatis 1 poll. latis e medio reflexis, segmentis interioribus oblongo unguiculatis erectis 8–9 lin. latis. *Styli* rami lilacini, 12–14 lin. longi, cristis magnis deltoideis.

BRITISH CENTRAL AFRICA. North-west of Lake Nyasa, *Whyte.*

The finest known species of the genus, with flowers resembling those of *Iris lævigata*, Fisch. (I. Kæmpferi, *Siebold*).

697. **Hæmanthus (Melicho) Nelsonii,** *Baker* [Amaryllidaceæ]; a speciebus reliquis subgeneris differt foliis magnis membranaceis, genitalibus longe exsertis.

Bulbus oblongus, compressus, 2 poll. diam., tunicis crassis bifariis rubellis. *Folia* synanthia, sessilia, oblonga, membranacea, pedalia, medio 4 poll. lata, facie pilis mollibus conspersa, dorso glabra. *Pedunculus* pedalis, pilosus. *Umbella* multiflora, globosa, 3 poll. diam., pedicellis 5–6 lin. longis, bracteis parvis linearibus reflexis. *Perianthium* coccineum, tubo cylindrico 3 lin. longo, segmentis linearibus tubo duplo longioribus flore expanso erecto-patentibus. *Stamina* longe exserta.

TRANSVAAL. Johannesberg. A dried specimen and living bulbs sent to Kew, November, 1897, by *Max Leichtlin.*

DCXXX.—MISCELLANEOUS NOTES.

By the death of Brigade-Surgeon J. E. T. AITCHISON, on September 30th, Kew has lost one of her most valuable contributors and botany one of its most enthusiastic and successful followers. He was a son of the late Major James Aitchison, and was born at Nimach, Central India, in 1835. After graduating M.D. and L.R.C.P. at Edinburgh in 1856, he entered the service of the Honourable East India Company as Assistant Surgeon. This was in 1858, and he retired in 1888. In 1872 he was appointed British Commissioner to Ladak; but he had already become known as a botanist, having published an account of the *Flora of the Jhelum District of the Punjab*, in 1863; a *Catalogue of the Plants of the Punjab and Sindh*, in 1869, and other papers on economic and geographical botany. His first collection of dried plants, comprising between four and five hundred species, was received at Kew in 1862. This was from North-west India, from districts that had been thoroughly botanized before, and contained few, if any, new plants; but his specimens were so carefully selected and so well dried that they were valuable for that reason alone. From the date mentioned

onward, Dr. Aitchison frequently sent small parcels of seeds and dried plants from the various districts in which he was stationed. During the winter of 1878 he served with the 29th Punjab Regiment, N.I., under General (now Lord) Roberts, and accompanied the troops in the advance up the Kuram Valley, the taking of the Pewarkotal, and the further advance, nearly to the Shutar Gardan Pass. The following year he was attached to the force as botanist; and during 1879 and 1880 he very thoroughly explored the country from Thal to the Shutar Gardan, at elevations ranging from 2,000 feet up to 13,000 feet on Mount Seratigah, and 15,000 feet on Mount Sikaram. The collection of 1879 consisted of 950 species, represented by 10,000 specimens, and was published in the eighteenth volume of the *Journal* of the Linnean Society. That made in 1880 was nearly as large, and was published in the nineteenth volume of the same *Journal*. Subsequently Dr. Aitchison was appointed naturalist to the Afghan Delimitation Commission, and on this expedition, during 1884–5, he collected some 10,000 specimens, comprising about 800 species. This very important collection was published in the second series, third volume, of the *Transactions* of the Linnean Society, and was illustrated by forty-eight plates; and, as the author states in his "Introduction," it was made under very great difficulties. The value of these collections is not to be estimated by mere numbers, though no fewer than fifteen botanical establishments, besides Kew, were enriched by receiving sets of the plants. Their value was greatly enhanced by local observation and information obtained on the spot. Each of the papers to which reference has been given was preceded by an essay on the vegetation and vegetable products, both wild and cultivated, of the country explored; and much light is thrown on the origin of vegetable drugs, for which Afghanistan and the adjoining countries are famous. Special papers followed on the economic plants, and they contain much original information. For the Kuram campaign he received the medal and clasp; in 1882 he was elected a Fellow of the Royal Society of Edinburgh; in 1883 he was elected a Fellow of the Royal Society of London, and in the same year he was created a Companion of the Order of the Indian Empire. For some time previous to his death he was engaged collecting materials for a *Flora Indiæ Desertæ* (*i.e.*, North-west India, Afghanistan, and Baluchistan), but his sufferings prevented him from working them out.

Dr. Aitchison was of an enthusiastic and energetic temperament, and of an amiable and warm hearted disposition, and many will feel his loss. Much of his success in collecting in a hostile country was due to his kindness to the natives, especially to the sick, whom he treated medically or surgically; and his reputation as a doctor preceded him in many places that he visited.

Descanso House.—It was stated above (p. 201) that "nothing seems known as to the origin of the name Descanso House" which is now devoted to the business offices of the Royal

Gardens. The following information which has been obligingly furnished clears up the matter :—

Rev. S. Goldney to Royal Gardens, Kew.

Dear Sir, Kew, September 5, 1898.

There appears to be some mystery as to the origin of the name Descanso Lodge. If the following information is of any use to you it is at your service.

In the year 1889 the house was tenanted by Mr. Willison. Mr. Willison was a South American merchant, who had lived many years in Brazil. He found that it had no distinctive name, so he gave it the title of Descanso Lodge.

A Portuguese dictionary informs me that Descanso, or rather Descanço, means "a resting place."

I remain, &c.,
(Signed) S. Goldney.

Enquiry at Her Majesty's Office of Works confirmed the explanation.

"Mr. G. Willison rented the house from Midsummer, 1888, till 3rd May, 1892. The name Descanso House appears first in a letter from him of 8th July, 1889, B. 4107/89."

Cantor Lectures on India-rubber Plants.—The lectures delivered at the Society of Arts in April last, by D. Morris, Esq., C.M.G., D.Sc., Commissioner of Agriculture for the West Indies, late Assistant-Director of the Royal Gardens, have been issued in separate form as a pamphlet. They give a complete account with numerous figures of the known plants yielding commercial India-rubber, with special reference to the rubber industries connected with Her Majesty's Colonial and Indian possessions.

Botanical Magazine for October.—*Cyrtosperma senegalense* is an interesting Aroid from Upper Guinea. The spathe is a foot to eighteen inches long, dull green and red on the outside, and pale yellow-green with broad interrupted bands of maroon-brown on the inside. Roots were sent to Kew in July, 1897, by Mr. H. W. L. Billington, the late Curator of the Old Calabar Botanic Garden. *Cytisus purgans*, native of Central and Southern France and Northern Spain, is an ornamental species, which, according to Miller, was introduced into England before 1768. *Amelanchier canadensis* var. *oblongifolia*, the swamp sugar pear, was raised from seed received from Mr. H. P. Kelsey, Highlands Nursery, Kawana, N. Carolina. It differs from typical *canadensis* in its smaller size and usually shrubby habit, and slightly in its leaves, racemes, and fruits. *Feijoa sellowiana* is a distinct member of the myrtaceous family, beautiful in foliage and flower, and producing a large edible fruit. Specimens of this plant, which is a native of South Brazil and Uruguay, were sent to Kew by Mr. Ed. André. *Rhododendron rubiginosum* is another of the

numerous species of *Rhododendron* discovered in Yunnan by the Abbé Delavay. The plant from which the figure was prepared was received from Messrs. James Veitch & Sons, of Chelsea, in 1894.

Coloured drawings of Burmese Orchids.—The widow of the late Rev. Charles Samuel Pollock Parish has presented Kew with two folio volumes of coloured drawings of orchids, executed by him. Long before orchid growing had become so popular as it is now, that is to say in 1852, Mr. Parish went to Moulmein, in Burma, where he remained until 1878. He was early attracted by the variety and beauty of the orchids, and began studying, drawing, and cultivating them. He also introduced a large number of living plants into this country. Almost from the first he was in correspondence with Kew, and a contributor to the Herbarium and Garden. When he came home in 1871 he presented a beautiful collection of water-colour drawings of orchids. These are accompanied by admirable analyses of the flowers. On his return to Burma he continued to send specimens and sketches or tracings of his original drawings. Now, in accordance with his wishes, Kew possesses the whole of his original, elegant and accurate drawings; a most valuable addition to the existing collection. In conjunction with the late Dr. H. G. Reichenbach, he published descriptions of a large number of new orchids in the *Transactions* of the Linnean Society (vol. xxx., 1873), illustrated by a number of plates from his own pencil. Parish also contributed the part dealing with the orchids in Theobald's Mason's *Burma* (1883), upwards of 350 species being enumerated, nearly all from the province of Tenasserim, and including 72 species of *Dendrobium*. Among the many species introduced by him into cultivation are *Sarcanthus Parishii*, Hook. f. (*Bot. Mag.* t. 5217); *Dendrobium senile*, Parish (t. 5520), and the highly curious *Bolbophyllum lemniscatum*, Parish (t. 5961). In 1870, Sir Joseph Hooker dedicated the ninety-sixth volume of the *Botanical Magazine* to him, as a tribute to the value of his many contributions to Kew, and to the plates of that publication. He died on October 18th, 1897, at the age of seventy-five years.

Bretschneider's History of Botanical Discoveries in China.– The following interesting letter from an old and valued correspondent of Kew, formerly physician to the Russian Embassy in China, gives some account of the progress of his monumental work on the history of Chinese Botany, in which British botanists and collectors have played so large a part. It also incidentally clears up the origin of *Arundinaria nitida*, the most beautiful of all hardy bamboos :—

St. Petersburg, May 18, 1898.

During the preparation of my great work "*History of Botanical Discoveries in China*," upon which I have been engaged for a quarter of a century, and which will be published in about four months, I have experienced very much kindness from Kew.

This liberality always shown to me encourages me to appeal once more to your obligingness, for a little information which I have not been able to draw from printed sources.

In my book I do not confine myself to give a sketch of the botanical discoveries in China proper, but I include also in the scope of my researches such tributary states of China, as Manchuria, Mongolia, Eastern Turkestan, and Tibet. As to the latter two countries, I intend to put on record the British share of botanical work done in these regions, which, in recent times, have been frequently visited by Russian explorers. Let me first tell you what I know about the matter from printed sources.

We read in the *Kew Report* for 1871 : "A very complete and valuable collection of Yarkand plants, the first ever made in that region, was presented to the Kew Gardens by Dr. Henderson." Dr. G. Henderson accompanied Forsyth in his first mission to Yarkand.

Kew Report for 1875 : "H. W. Bellew presented to Kew 208 plants collected at Kashgar and Kashmir." Bellew accompanied Forsyth in his second mission to Kashgar.

These two collections* probably constitute the only plants from Chinese Turkestan gathered by British explorers in the Kew Herbarium, although several British travellers have visited these regions in more recent time, viz. :—

A. D. Carey and Dalgleish, 1885–87 ; in 1887, Mark Bell and F. E. Younghusband, the latter, in 1889, travelled also in the Pamirs ; Major C. Cumberland and Lieutenant Bower, 1890 (Karakoram Pass, Yarkand). In the accounts these travellers have given of their journeys, no mention is made of collections.

The Botanic Gardens, St. Petersburg, received the first plants from Chinese Turkestan from Przewalski, who travelled there in the summer of 1885. You have probably at Kew specimens of this collection, for the late Maximowicz considered Kew as of high importance, and was always anxious to give complete sets of novelties discovered by Russians. The flora of Chinese Turkestan is not very rich. I may observe that of the plants which go under the name of Przewalski, only those from his first and second journeys, respectively 1870–73 and 1876, were gathered and prepared by himself. During the third and fourth journeys, the botanical collections were made by Roborovski, his able assistant, who also during Pevtsov's expedition to Tibet, 1889–90, was in charge of the botanical department. He collected in various parts of the tableland of Eastern Turkestan and on the Kuen-lun Range, which he crossed in several places to the plateau of Tibet. From this expedition, Roborovski brought home and handed over to our Botanic Garden 7,000 numbers of plants or 700 species. Only a few novelties have been described by the late Director Batalin and by Mr. Winkler.

Roborovski's last expedition, 1893–95, Turfan, Nan-shan, Amdo resulted in 1,300 species of plants, not yet examined.

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* Henderson's plants were worked up in Henderson and Hume's *Lahore to Yarkand*, 1873 (pp. 308–346). Bellew's plants presented no feature of special interest, and the list of these remains in manuscript

As to the botanical exploration of Tibet by British travellers, I take the western limits of Tibet in a geographical (orographical) sense and as they are marked on English maps, and do not include Ladak and Little Tibet. It does not seem that the Brothers Schlagintweit, who from 1854–58 explored the Western Provinces of India, also visited Tibet.

In the introduction to Hooker & Thomson's *Flora Indica*, 1855, it is stated that the French traveller Jacquemont, who botanized in the N. W. Himalaya, visited Tibet, and that Strachey and Winterbottom, in 1848, travelled there. They made an excursion to the lakes, which are the sources of the Indus, as is reported in *Hooker's Kew Journ. Bot.* VI. (1854) 348. Mr. Lance is stated to have collected plants in Kashmir and Tibet. His collection was communicated through Edgeworth. This is about all I know. But these collections were all made on the western border of the Tibetan plateau, and it seems to me that to Lieut. Bower belongs the credit of being the first European traveller who traversed Western Tibet, and that Dr. Thorold first collected plants in these regions.

I have, of course, seen all the interesting papers regarding recent British explorers in Tibet,—Pratt, Thorold, Littledale, Rockhill, Wellby, Malcolm, Deasy, Pike, Hobson, etc.

As Mr. Franchet reports in *Bull. Mus. d'Hist. Nat.* I. (1895) 191, the Museum at Paris received a collection of plants gathered by the unfortunate French traveller Dutreuil de Rhins on the western border of Tibet near Lake Pang-kong, and on the road leading from the lake to Keria and Aksay in Eastern Turkestan. Lake Pang-kong was probably visited earlier by British collectors (Strachey, Winterbottom).

Let me notice here that Dutreuil de Rhins sent his first botanical collection made in Chinese Turkestan to General Korolkov, Governor of Ferghana, the well-known promoter of natural science in Turkestan, who forwarded the plants to the Botanic Garden, St. Petersburg. From this collection Mr. Winkler described in *Acta Horti Petrop.* XIII. (1894) 245, a novelty: *Saussurea amblyophylla*.

You will be interested to know that Mr. Korjinski has taken upon himself to complete the *Flora Mongolica* commenced by Maximowicz. He is one of the three Chief Botanists or Assistants of the Director of the Botanic Garden, and holds the post formerly occupied by Maximowicz. He is a very able systematic botanist.

The Botanic Garden is now in possession of a vast collection of plants made in Northern Mongolia during the summers from 1893 to 1897, by Mrs. Elizabeth Klementz. This zealous and energetic lady accompanied her husband, Mr. D. A. Klementz, Secretary of the East Siberian Branch of the Imp. Geograph. Soc. (now Keeper of the Ethnological Museum of the Academy), who travelled in search of stone monuments with inscriptions of the ancient Turks who lived in these regions more than a thousand years ago. The couple Klementz are now about to start for a scientific expedition to Turfan.

Mr. Lipski, a young Russian botanist of great promise, is now

Keeper of the Herbarium of the Botanic Garden, a post previously for many years occupied by Mr. C. Winkler. He will continue Maximowicz's *Flora Tangutica* and work up the Tibetan plants of the Herbarium (Przewalski, Roborovski, Potanin).

Mr. C. Winkler, an experienced systematic botanist, a specialist for Compositæ, whose name you have frequently met with in the *Acta Horti Petropolitani*, is now Chief Botanist. It is his duty to determine the plants cultivated in the garden and the hot-houses.

In the *Kew Bulletin* (1896, p. 20) there is the description of a new Chinese bamboo, *Arundinaria nitida*, Mitford. It is reported to have been raised in England from seeds gathered by Potanin in N. Szechŭan and sent to the Botanic Garden, St. Petersburg. The plant has not been cultivated at St. Petersburg, nor are there herbarium specimens from Potanin. There is only one specimen from Dr. A. Henry's collection, communicated by Kew. I asked Potanin about this bamboo. He has no recollection of having gathered bamboo seeds, but Mr. M. Berezovski, who belonged to both of Potanin's expeditions to S.W. China, respectively 1884–86 and 1892–95—he did not travel with the expedition, but explored independently—when I spoke to him about it, told me that the bamboo in question may have been raised from seeds he had sent to St. Petersburg in 1886. In that year he spent the summer in a village near Tăn Chăng, in South Kansu (see my map of China, 34° N. lat., about 104° 25′ E. long), and it happened that the bamboos all round in the country flowered. Berezovski says this species, of the thickness of a finger and more, and about 20 feet high, is very common there, and the Chinese use it for many domestic purposes. They reported that the bamboo flowers only once in 100 years, and that old men remember having heard from their grandfathers that it flowered and seeded. Berezovski tells me that, after the flowering had finished, it seeded abundantly. The soil everywhere was thickly covered with these seeds, which the natives eagerly collected for food. Berezovski found a porridge or bread prepared of bamboo-seed meal very palatable. The seeds attracted many birds, and Berezovski acquired several rare specimens for his ornithological collection. After seeding, all the plants died, and even the roots. Thus, the people had to wait several years for new bamboos shooting up from the seeds. Berezovski then sent a considerable quantity of these bamboo seeds to St. Petersburg. He does not know what has become of them. I have not been able to make out whether these or other bamboo seeds have been forwarded to Kew. Maximowicz, Regel, the chief gardener Ender, who knew about them, all are dead. I enclose a sample of the bamboo seeds collected in 1886 by Berezovski. Do they agree with Henry's herbarium specimens, which are in fruit as far as I remember? Perhaps he collected them in the same year, 1886.

Mr. Berezovski is a clever and intelligent naturalist and traveller. Birds are his specialty, but he has also made very interesting collections of plants and seeds during his two exploring journeys in S. Kansu and North Szechŭan, 1884–86, and 1892–95 respectively, which have not yet been worked up.

A new expedition to Tibet is in preparation. It will be headed by Lieutenant Kozlov, who accompanied Roborovski in his last journey.

Hoping that you will generously pardon me for trespassing on your kindness.

I remain, etc.,

(Signed) E. BRETSCHNEIDER.

Lonicera hildebrandiana.—This large-flowered honeysuckle was discovered in Upper Burma, in 1878, by General Sir Henry Collett, K.C.B., F.L.S., and described in the *Journal* of the Linnean Society (Vol. XXVIII., p. 664) as "a conspicuous shrub, with large, dark, glossy leaves and fine crimson flowers seven inches long, and is by far the largest of any known species of honeysuckle." Seeds of it were kindly forwarded to Kew, in 1894, by Mr. A. H. Hildebrand, C.I.E., Superintendent and Political Officer of the Southern Shan States, after whom the plant is named, and plants raised from them were liberally distributed. It proved too tender for cultivation in the open air at Kew ; on the other hand, it has grown vigorously under greenhouse treatment, but has not yet flowered. Mr. F. W. Moore, the able Keeper of the Royal Botanic Gardens, Glasnevin, has, however, been more successful, flowers having been produced there in August last on a plant grown in a sunny, airy position in a greenhouse. The example forwarded to Kew by Mr. Moore bore two-flowered axillary racemes, with flowers six inches long, and of a bright, golden colour—not crimson, as stated in the note quoted above. Writing from Burma in April last year, Mr. Hildebrand said: "I am sorry that you are unable to flower the large honeysuckle and rose (*Rosa gigantea*). The former is a sight to behold just now in my garden, and strikes the densest in horticultural matters with astonishment. It is a mass of flowers, white when they open, and of a lovely gold when far spent. It flowers on last year's wood. Water at the roots is what both rose and honeysuckle require."

The oldest India-rubber Plantation in the World.—The following is an extract from the *Indian Forester* (vol. xxiv., pp. 160–161) :—

The oldest caoutchouc plantation in the world is perhaps one existing in the west of Java, in the province of Kranong. A former proprietor of the Pamanockan Tjiassan Estate, which is the biggest private property in Java, containing 540,000 Dutch acres, had most of his land under coffee until 1872. Finding the cultivation of this plant was no longer lucrative, he planted some of the land up with *Ficus elastica*. The coffee plantations had already been more or less cleared of forest growth, so that the planting of *Ficus elastica* cost less than thirty shillings per acre. The soil of these coffee gardens had become useless for other agricultural purposes ; and, had not *Ficus elastica* been planted in time, would only have become covered with poor forest

growth. The trees were planted 8¼ yards apart, or 72 trees to the acre. The area planted was 72½ acres, containing 5,200 stems. The trees were first tapped when the plantation was 14 years old, and the yield for that and the six following years was :—

Year.	lbs.	Average oz. per stem.	Value.
			£
1886	5,512	17	600
1887	4,954	15	540
1888	1,514	4	165
1890	3,307	10	360
1891	6,113	18	387
1892	5,992	18	256
1895	3,197	10	411
Total ...	30,589	Average per year per stem, 6 ozs.	£2,719

72½ acres thus, it is said, yielded in seven years a surplus of £2,712, or per acre per annum, £5 8*s*. The yield was 71 lbs. per acre per annum during this period. During the 23 years from the establishment of the plantation in 1872 till 1875 the net yield per acre per annum amounted to £1 12*s*. 10*d*.

A. H. BERKHOUT.
Late Conservator of Java Forests.

Wageningen, Holland,
6th January, 1898.

Esparto (*Stipa tenacissima*, L.).—Mr. T. S. Jago, Consul-General in Tripoli, gives the following account [*F. O. Annual*, No. 2125, pp. 11 and 12] of the commerce in this material :—

"Happily, in times of great necessity, an article growing wild in the country rescues the native Arab from starvation. I refer to halfa, or esparto fibre. The year 1868 saw the first exportation of this article from Tripoli. It grows wild all along the coast, from a little west of Tripoli to Khoms and Zleiten to the east, and inland to a distance of from two to five days' camel march. It all goes to England for paper-making purposes. That near the coast has long been eradicated by over-plucking in the early days, when the fibre fetched £12 per ton in the English market, now reduced to £3. In 1880, hand-presses gave way to hydraulic presses, causing a saving in bulk, and freight of 50 per cent. During the last 10 years the average yearly export has been 46,019 tons, of the value of £128,320. Last year (1897) 37,200 tons, valued at £74,400, were exported, showing the decreasing value of the article, consequent on the large use of wood-pulp in the manufacture of paper.

"The fibre attains maturity after three years' growth, under which age it is useless to the paper-maker, through lack of the necessary strength. No discrimination is exercised by the Arab

between mature and immature fibre, and as it appears incapable of natural reproduction it has entirely disappeared from these districts near the sea, where it formerly grew abundantly, necessitating its being sought for further afield among the hills and watercourses, two to five days' journey from the coast.

"This latter circumstance, coupled with the natural laziness of the Arab, in seeking to increase the weight of his load with the least possible toil to himself by plucking weighty and mature fibre, may probably delay the total extinction of the plant for some years to come. In the Algerian provinces, notably Oran, large plains formerly densely covered with the fibre, are now entirely denuded, and not a plant left, owing to the ignorance and thoughtlessness of the labourers.

"Despite the very little remuneration now offered by present prices to the peasantry, coupled with the long distance, whence it has now to be brought to a seaport, quantities have little diminished, showing the pecuniary assistance it affords to the peasantry when the cereal crops fail, through insufficient rainfall."

The following information respecting esparto in this country is taken from the Cantor Lectures on "Commercial Fibres," delivered in 1895, before the Society of Arts. The figures are brought down to July 15 of this year :—

"The extensive use of esparto for paper-making is greatly due to the exertions of the late Mr. T. Routledge. He commenced with a few tons at the Eynsham mills, about 40 years ago. It is of interest to note that the paper for the number of the *Journal of the Society of Arts* for November 28, 1856, was made of it. The use of esparto extended very gradually. The annual value has, however, of late reached nearly a million sterling. The United Kingdom has, hitherto, monopolised the supply. The imports for the last thirty years have been as follows :—

1861	891	tons.
1870	89,156	„
1880	191,229	„
1890	217,078	„
1898	204,257	„

"The highest imports were in 1888, when they reached 248,836 tons. Since 1890 they have somewhat declined.

"There is apparently a disposition, except in Scotland, to give up the use of esparto in favour of the cheaper and inferior wood-pulps. The fibres in esparto are easily dissolved and bleached. An authority on paper-making writes :—'They felt readily, and yield an excellent pulp, which is employed alone or mixed with rags, wood-pulp, or straw. They furnish a paper pliant, resistant, transparent, and of great purity ; thicker than other papers of the same weight, and forming a good printing and writing substance.' The falling away in the use of esparto for paper-making and the substitution of cheap paper-pulps must, therefore, be regarded as likely to lower the general quality of English-made paper."

The following Table will show the comparative value of esparto in 1878 and 1898 respectively. The great falling off in

prices of late years is due, as suggested, to the competition of wood-pulp. The figures are compiled from the circulars issued by Messrs. Ide & Christie, 72, Mark Lane, E.C. :—

Source and Quality.	Average Price per Ton.	
	1878.	1898.
	£ s. d.	£ s. d.
Spanish, fine to best	10 5 0	5 15 0
" fair to good	10 0 0	5 0 0
Algerian—		
Oran. first quality	7 10 0	3 6 3
" fair to good	7 0 0	3 0 0
Tripoli, hand-picked	6 10 0	3 1 3
" fair average	6 0 0	2 16 3

Messrs. Ide & Christie furnish the following additional particulars :—

"Total imports into the United Kingdom of esparto and other vegetable fibre for making paper, viz. :—

	1896.	1897.	1898.
	Tons.	Tons.	Tons.
Month ended 30th June...	17,952	18,268	15,512
Six months ended 30th June	103,707	110,977	110 655
Importation for twelve months ending June	200,806	194,549	204,257

"These statistics are the best evidence of the undiminished hold which esparto maintains on the estimation of British paper-makers, and, when read in conjunction with the enormous weight of the wood-pulp imports, testify to the remarkable expansion of the paper-making industry of this kingdom in recent years."

Gummosis of Prunus japonica, Thunb.

Wyman & Sons Lᵗᵈ. Lith.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 144.] DECEMBER. [1898.

DCXXXI.—GUMMOSIS OF PRUNUS JAPONICA, THUNB.

(*With Plate.*)

During the past two years a considerable number of examples of the beautiful flowering shrub, *Prunus japonica*, Thunb., growing in Kew Gardens, have been killed or much disfigured by a parasitic fungus belonging to the genus *Cladosporium.*

The disease is first indicated by the appearance of tear-like drops of almost colourless gum on the branches. These drops are sometimes solitary, in other instances numerous and more or less crowded.

The drops continue to increase in size for some time, often forming masses varying in size from a marble to that of a walnut, and when two or more originally distinct drops coalesce the resulting mass usually becomes irregularly nodulose and contorted.

During damp or rainy weather the masses of gum are quite soft and gelatinous, with just sufficient consistency to hold together, or sometimes during a heavy rain drip away by degrees. In very dry, warm weather the mass shrinks very considerably in size and becomes horny, expanding again when moistened.

As previously stated the mass of gum is almost colourless at first, becoming steel-grey as it increases in size, and finally black. The black colour is however confined to a surface layer, the central portion remaining colourless. This is most evident on cutting through a mass that has been hardened in spirit.

In the end these outflows of gum are always washed to the ground by rain, where they eventually dissolve and disappear.

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When the black masses are removed irregular canker-like wounds, sometimes extending to the pith, are present on the branches ; if such wounds are numerous, and occur on different sides, the branch dies at once ; whereas if the wounds are confined to one side of the branch, most frequently the under side, it may continue a feeble existence until the following season, when it almost invariably succumbs, owing to the formation of new disease spots.

The fungus is a wound-parasite gaining access to the living tissues through small wounds in the bark, broken branchlets, and more especially at those points where leaf-buds or flower-buds have been broken off, and as birds remove these buds rather freely, probably in searching for insect larvæ, the opportunity for infection is ample.

The following account of the life-history of the fungus is founded on observance of the sequence of development and microscopic examination of material resulting from artificial inoculation of previously healthy specimens.

Whether inoculation is effected by means of spores or conidia, the first product is invariably a *Cladosporium*, which morphologically appears to be in exact accordance with the ubiquitous species, *C. epiphyllum*, Fries, although physiologically, the two are widely separated ; neither am I aware that any known species of *Cladosporium* has been described capable of promoting the disease known as gummosis, as is the case with the form under consideration.

Inoculation was effected by placing spores in a small wound made in the bark, or on the surface of the wound caused by breaking off a leaf-bud. Oiled silk was immediately tied round the branch at the points inoculated, and allowed to remain for ten days, as a preventive against complications that might possibly have arisen from undesired inoculation by foreign, floating spores.

The fasciculate sporophores appeared at the points of inoculation at periods varying from sixteen to twenty days after infection took place, and remained for about another fortnight, all the while producing spores, after which they gradually disappeared ; their position becoming occupied by a small drop of gum.

If a section is taken through a disease spot at this stage, it will be seen that the hyaline, slender, septate, and much branched mycelium has extended to a distance of about 2 mm. on all sides, from the point of infection, and has also passed down to the cambium. Towards the centre of the diseased spot the tissue is completely disintegrated, the transformed material oozing to the surface as the drop of gum already alluded to. Towards the periphery of the infested portion of tissue, the slender hyphæ can be seen in the cells, having perforated the wall, probably by means of a ferment secreted by the tips of the hyphæ. There is very little discolouration of the tissue, just a tinge of brown in the contents of cells recently attacked.

Returning to the small drop of exuded gum—the increase in size of which may be taken as an index of the activity of the

hyphæ of the fungus in disintegrating and converting into a gummy substance the tissues of the host—which usually retains a more or less spherical form and a hyaline or very pale amber colour until about the size of a pea, when it becomes tinged with grey on the surface. If a globule at this stage of development is hardened in spirit, and afterwards examined in section, its substance will be seen to be permeated by innumerable, slender, hyaline, septate hyphæ, agreeing in all essentials with the hyphæ of the fungus present in the tissues of the host. These are in reality an extension of the hyphæ of the parasite into the external mass of gum for the purpose of producing secondary reproductive bodies.

The hyphæ radiate from the base of the globule of gum, and continue to grow until within a very short distance from its periphery, but never protrude beyond the matrix.

At the stage indicated, the grey tinge observable on the surface of the mass of gum is due to the formation of larger, thick-walled cells, arranged in a moniliform manner, and of a pale smoky-grey colour, at the tips of those branches of hyphæ situated nearest the outside of the gum matrix.

The mass of extruded gum continues to increase in size, and the included hyphæ keep pace with this extension, always keeping just within the circumference. At the same time the terminal moniliform strings increase in number, size, and depth of colour, imparting to the mass of gum the black colour indicating what may be termed the period of maturity.

If during the period of formation of the mass of gum, the weather has been continuously moist, the included hyphæ radiate in comparatively straight lines from base to circumference of the mass. On the other hand, if, after a period of damp weather, the mass of gum loses its moisture and contracts, owing to heat, the hyphæ assume a spiral or cork-screw form as the means of accommodating themselves to the altered conditions, and when the mass again expands after being moistened, the coils of hyphæ do not unfold, the tips resuming growth in a straight line so long as conditions are favourable for so doing; consequently when during the formation of a gum-mass, spells of rain and dry hot weather have alternated, this is indicated by the alternation of spiral and straight zones of hyphæ in its interior.

If, after hardening in spirit, a section of a black mass of gum is examined, the internal portion is seen to be crowded with delicate hyaline hyphæ, all trending towards the circumference, as already explained, and possessing no feature of special interest, but as we approach the periphery of the mass, these slender hyphæ become tinged with grey, and gradually widen out into the strings of dark-coloured, thick-walled cells previously mentioned.

These terminal chains of dark cells are very irregular in structure, sometimes consisting of strings of elliptic or sausage-shaped cells, much constricted at the septa, frequently branched, and bearing at the tip of each branch, sometimes also intercalary, very large, subglobose, thick-walled cells. Other strings consist of large quadrate or irregularly angular cells, which at times coalesce to form solid masses of tissue resembling micro-sclerotia.

A black mass of gum that had been collected and allowed to dry and contract for several days, was then hardened in spirit, and on examination it was found that most of the large cells described above had germinated, and produced innumerable very minute hyaline sporules, many of which were reproducing themselves by a process of budding, *Torula*- or *Saccharomyces*-fashion.

After this discovery another mass of black gum was collected and allowed to become perfectly dry and horny. After remaining in this dry condition for several weeks, a portion of the material was examined, and the same process of germination and reproduction of sporules by gemmation was seen to have occurred. After another interval of some weeks, during which the material remained perfectly dry, a fragment was placed in a hanging drop of sterilized water, and reproduction of sporules by gemmation was soon as active as if the process had never been interrupted, the matrix of gum presumably serving as nutrient material.

Germination of the large brown cells, and continued reproduction of the sporules by gemmation in a dense matrix of gum comparatively devoid of air, suggested the idea that under certain conditions the fungus could exist as an anaerobic organism. For the purpose of testing the validity of this idea, two flasks of nutritive solution, consisting of thoroughly sterilised colourless masses of the gum exuded during the early stage of the disease and dissolved in water, were prepared according to Kitasato's method, which practically consists in excluding the air by a layer of paraffin poured on the surface of the nutrient solution.

Seven days after inoculation the contents of the flasks were turbid, and microscopic examination showed this turbidity to be due to the presence of myriads of sporules, mostly arranged in chains of two to four cells.

When removed to hanging drops of the same nutrient solution those anaerobic sporules refused to grow, and inoculations of the host plant with them produced no sign of the disease.

Grown in hanging drops or in flasks as aerobic organisms, the large brown cells gave origin to a very stout, hyaline mycelium composed of two to four cells, constricted at the septa. When full grown, these hyaline cells give origin from every portion of their surface, but most abundantly near the septa, to numerous small elliptical sporules, which generally form chains consisting of two or three cells by acropetal growth. The sporules soon fall away from the parent mycelium, and continue to reproduce themselves by gemmation, soon rendering the nutrient solution turbid by their immense numbers.

The product of germination just described corresponds to what has been described as *Dematium pullulans*, well known as a phase in the life-cycle of *Cladosporium.*

The *Dematium* sporules or conidia readily produce the disease when placed on a wounded surface of the host.

Fragments of the sporophores of *Cladosporium*, when placed in water, also give origin to the *Dematium* form of reproduction.

Preventive Measures.

The disease, which spreads rapidly, was checked by spraying with a solution of potassium sulphide.

Diseased branches should be removed, as the mycelium is probably perennial in the tissues, and would consequently give origin to the disease the following season.

Quicklime should be placed on the soil under diseased plants for the purpose of destroying the sporules produced from the fallen masses of gum.

Summary.

Gummosis of *Prunus japonica*, Thunb., is caused by a species *Cladosporium*, morphologically indistinguishable from *Cladosporium epiphyllum.*

The masses of extruded gum are permeated with the hyphæ of the *Cladosporium*, which bear large, thick-walled, dark brown cells, or masses of cells resembling micro-sclerotia at their tips, situated just within the periphery of the mass of gum, and imparting to it a black colour.

These large cells and micro-sclerotia, when caused to germinate in the absence of air, give origin to myriads of very minute sporules, which reproduce themselves by gemmation; under these conditions hyphæ are not formed.

Grown in a nutrient solution in the presence of air, the form of reproduction once known as *Dematium pullulans* is produced.

Inoculation with the *Dematium* sporules produces the disease. No results were obtained from infections with the sporules of the anaerobic condition.

Bacteria were entirely absent from the masses of gum during every phase of development.

Description of the Figures.

Fig. 1. Portion of a branch of *Prunus japonica*, Thunb., bearing two masses of gum; nat. size.

„ 2. *Cladosporium*-form of fruit; × 400.

„ 3. Section of a portion of the periphery of a black gum-mass, showing the hyphæ of the *Cladosporium*; × 80.

„ 4. Dark coloured tips of hyphæ from the periphery of a gum-mass, bearing large, thick-walled, brown cells; × 400.

„ 5. Large thick-walled, brown cells germinating in a nutrient solution in the absence of air, and producing yeast-like cells, which reproduce themselves by gemmation; × 400.

„ 6. Stray cells which are emitting a germ-tube, seen in the material described in 5.

Fig. 7. Micro-sclerotia germinating under conditions similar to those described under 5, and producing similar sporules ; × 400.

„ 8. Large brown, thick-walled cells germinating in a nutrient solution with free access of air, and producing the form of fruit known as *Dematium pullulans* ; × 400.

„ 9. Sporules of the *Dematium* increasing by gemmation ; × 400.

„ 10. Fragments of sporophores of *Cladosporium* producing a slender form of *Dematium pullulans* ; × 400.

„ 11. A form of *Macrosporium* often appearing on old canker-spots caused by the *Cladosporium*. No genetic connection between the two could be established ; × 400.

„ 12. Spore of the *Macrosporium* germinating ; × 750.

G. MASSEE.

DCXXXII.—THE ADVANCES MADE IN AGRICULTURAL CHEMISTRY DURING THE LAST TWENTY-FIVE YEARS.

An important address has been recently delivered by Professor MAERCKER, of Halle, to the German Chemical Society (*Ber.* 1897, p. 464), summarising the advances which have been made in agricultural chemistry during the last twenty-five years. Professor Maercker pointed out that the term Agricultural Chemistry meant more at the present time than the mere application of chemistry to agriculture, as shown by the fact that the agricultural chemist, in his efforts to assist the farmer, was often more concerned with the biological sciences than with chemistry ; while, in addition to his purely scientific work, he was required to take account of economic questions of the day possessing special interest to agriculturists. The following account of the most important parts of the address is given under the following heads :—I. Plant-food ; II. Soils and Manures ; III. Artificial Selection. It is reproduced here by the kind permission of the Editor of the *Imperial Institute Journal*.

I. PLANT-FOOD.

In supplying nourishment to plants we must know what substances are necessary, and in what form and quantity they should be provided. Little progress was made in our knowledge of the subject till the quite recent introduction of the method of water-cultures of Sachs, Knoop, and Nobbe and the method of sand-cultures of Hellriegel permitted of the conduct of experiments in pure media, and thus rendered it possible to ascertain not only what substances are essential for plant life, but also the

part played by each substance in the plant cell. Thus we know now that phosphoric acid is essential for the formation of nitrogenous substances in the plant, because the albumens, which are of fundamental importance in the transformations of substances in plants, result from an intermediate phosphoric acid compound, as is indicated by the regular occurrence of lecythin in protoplasm. Again, iron is an essential constituent of chlorophyll and sulphur of albumen, and hence must be supplied to plants. The true function of calcium was for long doubtful; its action is now known to be of a medicinal character, since it serves to neutralize the poisonous oxalic acid, which is always an intermediate product of the oxidation of the carbohydrates. It was formerly thought that calcium fulfilled some important function in the leaves, being chiefly found in the foliage of plants. Since, however, the leaves are also the chief seat of the oxalic acid, this distribution of the calcium is easily explained.

The part played by potassium has only within the last three years been explained by Hellriegel, who, by exact experiments with beet-root showed that the amount of sugar in the beet stands in close relation to the amount of potassium provided for the plant. P. Wagner has made the interesting observation that the potassium may be *partly* replaced by sodium.

The exact value of magnesium to plants is not yet well understood, but it appears to be of importance in the formation of the nitrogenous substances of seeds, as in these considerable quantities of magnesium phosphate occur.

Nitrogen is an indispensable plant-food, for it is an essential constituent of albumen.

In addition to the quantities of mineral substances required by plants to enable them to exhibit a healthy growth, further quantities are found to be essential to satisfy what has been termed, though not very aptly, the "*mineral-hunger*" of the plant. This is best explained by an example. E. Wolff found that for the production of 100 parts of oat-plant (dried), ·5 parts of phosphoric acid were necessary, when the remaining mineral substances were supplied in excess to the plant. By other similar experiments he showed that the following quantities of mineral substances were necessary for the production of 100 parts of oat-plant :—

Phosphoric acid	·50 parts
Potash	·80 ,,
Lime	·25 ,,
Magnesia	·20 ,,
Sulphuric acid	·20 ,,
	1·95 parts.

A total of 1·95 parts of mineral substances is therefore *necessary* in the case of the oat-plant. However, there is no oat-plant in nature which contains so little as 1·95 per cent. The minimum is 3 per cent. The difference, 1·05 per cent., is the measure of the

"mineral-hunger" of the plant, and represents the mineral substance which does not perform any special function. This excess of mineral substance may be supplied in the form of some indifferent substance, such as silica. The observation is of considerable interest to the farmer, for it shows that it is not economical to manure crops with pure substances.

II. Soils and Manures.

Having ascertained in general what substances are necessary as plant-food, the agricultural chemist has next to apply this general information to the manuring of soils which are more or less deficient in certain ingredients. It has been found, unfortunately, that the chemical analysis of a soil is of little use as a guide unless accompanied by what may be termed a "mechanical analysis," by which is meant chiefly a determination of the amount of finely-divided constituents present in the soil. It is only the finely-divided earth which presents a sufficiently large surface for the exercise of the solvent action of the water and its dissolved carbonic acid. There is one case, however, in which chemical analysis alone is of the greatest importance, viz.: when only traces of some necessary element are present in a soil. Here there is no question of the need for a manure containing this substance.

If, on the other hand, large quantities of an element are present, it does not follow that there is a sufficiency in the soil even when the latter is in a satisfactory state of division, for the substance in question may be present in an insoluble or refractory form. This is commonly the case with nitrogen, which exists in the soil chiefly in the form of a mixture of indefinite nitrogenous substances known as *humus*, or mould. These substances sometimes easily give up their nitrogen to plants, but in other cases are very refractory. The uncertainty as to their action is indeed so great that certain peaty soils are known which consist almost entirely of humus, but contain, nevertheless, an insufficiency of available nitrogen.

Phosphoric acid affords another illustration. The soluble phosphoric acid of the manure is absorbed by the soil as dicalcic phosphate, which is comparatively easily soluble in the soil-water. With time, however, it may change in the soil to the insoluble tricalcium phosphate, or even to iron or aluminium phosphates, which are still less soluble.

In the case of calcium, chemical analysis has been found to be of considerable service in determining what manuring is required, since calcium is chiefly valuable in the form of carbonate or humate, and these are easily estimated in the soil.

Since then the direct method of soil-analysis is an insufficient guide to manuring, it is fortunate that chemists have been able to develop successfully an indirect method. This is the *cultivation method*, by which plants are allowed to grow in the soil under examination, after taking care to provide a sufficiency of all plant-food stuffs except the one, *e.g.*, phosphoric acid, whose presence in available form is being tested. The plants are then

analysed, and the results compared with the analyses of the same plants grown on soils provided with all the necessary plant-food stuffs. As an important result of the method it has been found that different plants take up very different quantities of the same mineral substances. On this is largely based the system of rotation of crops, where the second crop is so chosen that it chiefly removes the ingredients of the soil which have been left by the preceding crop.

With the aid of the cultivation method it has also been possible to draw up the following table which represents the relative values of the different nitrogen compounds for plant-food.

Nitrogen of Saltpetre	100
„ „ Ammonia	85–90
„ „ Albumen	60

This table may be made use of in determining the nitrogen value of a manure.

The cultivation method may be used for testing the value of manures of all kinds. Thus it was by a few cultivation experiments that Wagner in Darmstadt first showed the very great value for agricultural purposes of the "Thomas" Slag, produced as a bye-product in the manufacture of iron by the basic process of Thomas Gilchrist. The million tons of phosphate meal annually produced in Germany is now wholly utilised by the agriculturist, and its preparation for the farmer has become an important offshoot of the iron industry.

Similarly the demonstration by the cultivation method of the value of potash salts in manures has given an enormous impetus to the potash industry.

Speaking generally, the method gives us complete control over the fertility of a soil in so far as this depends on manuring. One consequence of this has been that our views as to the value of agricultural land have completely changed, for whereas formerly sandy soils were generally considered poor, they are now, by means of a system of intelligently directed manuring, made to give yields which are scarcely inferior to those of the best soils. The beet-sugar industry, which formerly could only be conducted in the best soils, has now been extended with marked success to sandy soils.

III. Artificial Selection.

It might seem that with a perfect knowledge of the manuring of plants, the need for further investigation would cease, for when we have learned exactly what each plant requires to attain its highest development, we have reached a certain limit. The supply of excessive nourishment is a disadvantage, and only tends to produce sick plants.

There still remains, however, a method by which the fertility of plants may be increased far beyond the limit which nature appears to have fixed. This is the method of artificial selection which has been applied in Germany on the most approved scientific principles. German agriculture would have long since

broken down under the stress of foreign competition had it not been for the perfect technology of its agriculturists. As an example, the sugar-beet may be quoted. This plant contained originally but a small amount of sugar, and could only be used as a source of sugar when the price of the latter was very high. With the fall in price came the urgent need for increasing the percentage of sugar in the beet-root. This was effected by utilising the fact that sugar-richness is hereditary, so that by selecting artificially the roots richest in sugar, getting seed from these, planting the seed, again selecting the richest roots, and so on, a race of plants is at length obtained in which a high percentage of sugar is normal.* Accordingly the producers of beet-root seed in Germany have erected great laboratories in which the percentage of sugar in the roots is carefully determined. By applying the principle of artificial selection with regard also to the form and size of leaf and the purity of the sap, it has been found possible to improve the roots from year to year, so that now beet-sugar can easily hold its own against cane-sugar, and is indeed cheaper than flour, costing as it does in Germany less than a penny a pound.

Similar success has attended the efforts to increase the crops of different kinds of grain. The improvement in malt-barley has been specially marked.

It has been found that plants which have been highly cultivated by artificial selection easily lose their acquired characters when they are exposed to unfavourable conditions of cultivation ; and this has led to many exact investigations, conducted for the most part in Germany, during the last ten years, on the chemistry of plants. The most interesting of these trace the chemical history of nitrogen as it passes from the atmosphere to the soil, then into the substance of plants, and finally back into the atmosphere.

The corresponding cycle for carbon has long been known.

Most plants assimilate nitrogen only in the form of compounds. As, however, the total quantity of nitrogen compounds in the atmosphere is comparatively small, there must be some other source of nitrogen for plants. Now the classical researches of Hellriegel have shown that there is one class of plants, the *Leguminosæ*, or nitrogen collectors, which are able to assimilate elementary nitrogen and so to leave a soil in which they have been grown richer in nitrogen compounds. It has been found that the power of acting as nitrogen collectors is always associated with the presence of micro-organisms on the roots, and that the assimilation of the nitrogen is in some way not understood due to the micro-organisms. The recognition of the power of leguminous plants to act as nitrogen collectors is manifestly of great practical importance, for it shows clearly that the best rotation of crops is one in which a leguminous crop is followed by one of nitrogen consumers, *i.e.*, plants which cannot assimilate nitrogen directly.

Leguminous plants, whether first used as fodder for animals or simply left to decay in the soil, have their albumen changed in the first instance to amides, which under the influence of

* See *Kew Bulletin*, 1897, pp. 317, 318.

ammonia-ferments are decomposed with formation of ammonium-carbonate. The saltpetre bacillus then converts the ammonium-carbonate (and probably also amides) into saltpetre, *i.e.*, into the best form of nitrogen plant-food.

Unfortunately the whole of the nitrate thus formed is never available for plants, on account of the destructive action of the nitrate-destroying bacilli, which decompose the nitrates with evolution of free nitrogen, and so complete the nitrogen cycle.

The nitrate destroyers are usually present in stable-manure, and cause a deplorable loss to agriculture, amounting in Germany to a sum of several million pounds annually.

Efforts which, as Professor Maercker assured the German Chemical Society are likely to meet with success at an early date, are being made to avoid this loss; and for this purpose special bacteriological investigations are now being conducted at many agricultural stations in Germany.

DCXXXIII.—IMPROVEMENT OF SUGAR-CANE BY CHEMICAL SELECTION.

The *Kew Bulletin* for 1894 (pp. 86–96) contained an account of the experiments made in Louisiana for the improvement of the sugar-cane by continued selection of "seed canes," *i.e.*, of the canes used for propagation. The principle was essentially the same as that which has been applied to the improvement of the sugar-beet (see *Kew Bulletin*, 1897, pp. 317, 318). The method has begun to attract some attention in sugar-growing colonies. The following remarks are quoted by the Queensland *Sugar Journal and Tropical Cultivator* for April 15 last from Mr. McCulloch, the Government Inspector under the Sugar Works Guarantee Act :—

"Unfortunately, the improvement of our canes or the propagation of new varieties by means of seed or otherwise is a slow and tedious process, and we are, therefore, debarred from individually improving our varieties by this means. This being so, we should give careful attention to accidental variations which undoubtedly do occur. In most canefields a stool, or stick of cane in a stool, is often found having characteristics quite unlike in appearance to the mother plant. These are known as 'sports,' or accidental variations. Where observed these canes should be carefully noted and used for future planting, keeping them in a field, or corner of a field, by themselves. Then, again, one can almost always notice in a canefield a few stools or sticks far and away cleaner, healthier, and bigger-looking than the others. These, also, should be carefully noted and used for future planting. This is known as 'seed selection.' It is by such means as these, also by careful and intelligent cultivation, drainage, manuring, &c., by observing the adaptability of the soil to the plant, carefully recording the season it was planted, the cultivation bestowed on it, the manner of stooling, number of canes in a stool, that every individual cane-grower in Queensland can do his little or more to better the

varieties of our canes. Such data, if intelligently kept and recorded, would, in the course of a very few years, result in considerable pecuniary gain to both miller and grower. The propagation of varieties from seed can only be done scientifically under State supervision, and it is to be hoped the day is not far distant when this will be recognized in this Colony, and a well-equipped experiment station take this matter in hand. Till then our cane-growers must help themselves, as above suggested, never forgetting that what little one discovers, added to that which another does, and so on, if carefully recorded and published for each and every one's benefit, will be the means of securing data that should prove of incalculable benefit to the sugar industry generally, and of material help to any experiment station which may be started later on. It goes without saying that the manufacturer has also a duty to perform, and can aid individual effort on the part of cane-growers materially by encouraging the growth of varieties rich in sugar, by paying a higher price for such cane, by analysing varieties for growers free of charge, and by encouraging them in every possible manner."

Mr. Bovell and Professor d'Albuquerque give the following account in their " Report of experiments made on the experimental fields, at Dodds Reformatory " (1897, pp. 26–29) :—

" The experiment was made at the suggestion of Mr. Thiselton-Dyer, Director of the Royal Gardens, Kew, and is a repetition on a small scale of experiments made in the years 1890, 1892, by Messrs. Thompson and Edson, at Calumet plantation, Louisiana. The object was to ascertain the possibility of increasing the average richness and purity of the juice of a given variety of sugar-cane, by chemical analysis of the juice from each of the ' seed canes,' *i.e.*, canes from which the plants are to be taken, and by the selection of those plants from the seed canes which were found by the analysis to yield the richest and purest juice.

" Accordingly, the lower half of each of a number of canes was crushed and the juice of each analysed, and the upper remaining joints of each cane, the juice of which contained more than the average amount of available sugar, were planted in a plot by themselves, and all below the average by themselves ; a plot was planted at the same time in the ordinary way, that is, with cuttings taken indiscriminately from the ordinarily well grown canes.

" Burke canes were used for this experiment. Thirty holes of each of these plots were reaped, and the results are recorded in the tables below.

" The plot of canes planted from ' high ' seed cane yielded a juice of higher sucrose content and lower glucose content than the plot planted from ' low ' seed cane.

TABLE I.

Results of Reaping the Canes.

——	No. of Canes		Weight per Acre of								Weight in lbs. of one			Increase or decrease on the Burke in cwts. per acre of	
	per acre.	per clump.	Produce.		Cane Tops.		Good Canes.		Rotten Canes.		Cane Top.	Cane.	clump of Canes.	Produce.	Canes.
			Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.	Tons.	Cwts.					
Burke, High Plot ...	20,789	11·9	45	3·7	10	13·6	34	10·1	10	17·8	1·15	3·7	44·0	+ 137·9	+ 114·1
„ Ordinary Plot ...	21,428	12·3	38	5·8	9	9·8	28	16·0	9	18·1	·99	3·0	36·9	...	...
„ Low Plot ...	22,068	12·6	37	9·2	8	9·9	28	9·3	6	16·9	·91	2·9	36·8	− 16·6	− 6·7

TABLE II.

Results of the Crushing of the Cane.

—	167° F.	60° F.	Juice by mill per cent.	Lbs. per Impl. galls. of		Lbs. per acre of		Increase or decrease on the Burke of available sugar per acre.
	Impl. galls. juice per acre.	Density, Beaumé.		Sucrose.	Glucose.	Sucrose in juice.	Available sugar in juice.	
Burke, High Plot ...	5,006	9·89	67·97	1·63	·103	7,999	7,242	+ 1,516
„ Ordinary Plot	4,187	9·66	67·98	1·58	·119	6,457	5,726	—
„ Low Plot ...	4,065	9·55	66·72	1·56	·114	6,204	5,524	– 202

TABLE III.

Composition of the Juice of the Canes.

—	Water.	Sucrose.	Glucose.	Ash.	Organic matter.
Burke, High Plot	81·64	15·23	·96	·38	1·79
„ Ordinary Plot	82·11	14·72	1·11	·35	1·71
„ Low Plot...	82·42	14·58	1·07	·43	1·50

DCXXXIV.—MISCELLANEOUS NOTES.

MR. HENRY MILLEN, since 1890 Curator of the Botanic Station at Lagos, where he had done excellent service, has been appointed, on the recommendation of Kew, by the Secretary of State for the Colonies, Curator of the Botanical Station recently established in Tobago.

MR. WILLIAM HENRY JOHNSON, who went out to the Gold Coast in January, 1898, as Acting Curator of the Botanic Station at Aburi, has been confirmed in the appointment on the resignation of Mr. C. H. Humphries.

Mr. Albert Edouard Pierre Griessen, a member of the Gardening Staff of the Royal Gardens, has been appointed, on the recommendation of Kew, by the Secretary of State for India in Council, a Probationer Gardener for employment in the Royal Botanic Gardens, Calcutta.

Sir Henry Barkly, G.C.M.G., K.C.B., F.R.S.—Botany has been promoted, and Kew has greatly benefited by the action of many Colonial Governors, but probably none have done so much as the late Sir Henry Barkly, who died at his residence in South Kensington, on October 21st, 1898, at the age of eighty-three. Successively Governor of British Guiana, Jamaica, Victoria, Mauritius, and the Cape of Good Hope, he had excellent opportunities for indulging his taste for Botany, and exercising his influence over Colonial Botanical Institutions. His correspondence with Kew goes at least as far back as 1852, when he wrote to the late Sir William Hooker, from Government House, Georgetown, British Guiana. He advises the despatch to Kew of a wardian case containing ferns, lycopodiums, jungermannias, and a "new dwarf *Sobralia*." The following year (1853) Sir W. Hooker dedicated the seventy-ninth volume of the *Botanical Magazine* to Sir H. Barkly, "who, amidst the many arduous duties attendant upon his high office, has patronized and encouraged horticulture and botany in our colonies." In 1858 the late Sir Ferdinand Mueller dedicated a handsome genus of the Sophoreæ, *Barklya syringifolia* to him. This is a monotypic genus inhabiting the Brisbane river district, and is figured in Mueller's *Fragmenta* (i. t. 3). It was introduced into English gardens the same year, and is still cultivated at Kew; but it grows very slowly, and does not appear to have flowered in this country. At this time he was Governor of Victoria, and his first letter from thence in the Kew correspondence (March, 1857) is almost entirely devoted to Botany and gardening. He specially mentions Mueller's return from Gregory's North Australian Expedition, and states that Mueller was most impressed by the existence of a species of baobab in Australia. His interest in plants never flagged. It would occupy too much space to enter into particulars of the many things he sent to Kew—seeds, living and dried plants, and museum objects. In South Africa, his last sphere of active official life (1873-7), he paid special attention to succulent plants, and more particularly to the Stapelieæ. He collected and cultivated as many of this tribe as he could, and also sent a large collection of living plants to Kew. Lady Barkly and Miss E. B. Barkly made water-colour drawings of them as they flowered. Copies of these drawings were sent to Kew, together with specimens in alcohol, accompanied by copious descriptive notes. A portion of this material was published in Hooker's *Icones Plantarum*, plates 1901-1925; and coloured figures of a number of others that flowered at Kew appeared in the *Botanical Magazine*. Sir Henry was also instrumental in the re-introduction of *Aloe dichotoma*, and other species of this characteristic African genus. He was joint author with Colonel Pike of a report on the flora

and fauna of Round Island, near Mauritius. Although he himself published very little he contributed largely in the way of notes and specimens to several of our Colonial *Floras*, and it was due to his support that the approval and aid of the legislatures of Cape Colony and Natal were secured for the continuation of the *Flora Capensis*. He was elected a Fellow of the Royal Society in 1864.

Botanical Magazine for November.—*Astragalus ponticus* is one of the numerous representatives of the genus in Asia Minor, whence seeds were sent to Kew by Edward Whittall, Esq., of Smyrna. Its vigorous habit, and globose or ovoid, almost sessile heads of yellow flowers in the axils of the long leaves are characters which it has in common with *A. narbonensis*, to which, in other respects also, it is closely allied. *Kniphofia longicollis* is a new species from Natal, and is one of the recent introductions of Mr. Max Leichtlin, of Baden. The drawing was made from a plant which flowered in Mr. Gumbleton's garden at Queenstown, County Cork. *Aloe leptophylla* was first discovered nearly forty years ago in the province of Worcester, Cape Colony, by Mr. Thomas Cooper, from whom the Kew plant was purchased. It is a decidedly ornamental species, having leaves freely spotted with white and capitate racemes of bright orange-yellow flowers, tipped with green. In *Podotheca chrysantha* is represented a singular genus of Compositæ, which consists of six species, all confined to Western Australia. *P. chrysantha* is an erect, slender annual, each branch being terminated by a lax head of bright yellow florets. The Kew plants were raised from seeds communicated by Miss Bunbury, of Picton, Western Australia. *Calliandra fulgens* is a distinct and handsome new species from Mexico. Though allied to *C. hæmatocephala* it is easily distinguished by the pubescence on the leaves and the much smaller number of leaflets. The plant drawn was received from the gardens of the Royal Botanic Society, Regent's Park, in 1888.

Handbook of the Flora of Ceylon.—The first volume of this addition to the series of Colonial *Floras* was announced in the *Kew Bulletin* for 1894, p. 34, and the death of the lamented author in that for 1896, p. 219. It was further announced (1897, p. 208) that Sir Joseph Hooker had undertaken to continue the work. Dr. Trimen published three volumes, containing the orders Ranunculaceæ to Balanophoraceæ; the arrangement followed being that of Bentham and Hooker's *Genera Plantarum*. He also left the manuscript of the Euphorbiaceæ nearly ready for press. In a comparatively short period, considering his advanced age, Sir Joseph Hooker has completed the fourth volume. This comprises the orders Euphorbiaceæ to Naiadaceæ. With it are issued twenty-five additional quarto coloured plates, making one hundred in all, and completing this part of the work. It is interesting to note that no Coniferæ inhabit the island; that

160 species of orchids, belonging to sixty-one genera, are described: and that only six genera of palms are represented by native species. It is also satisfactory to add that Sir Joseph Hooker is well advanced with the concluding volume, being at the present time engaged on the grasses.

Alluding in the preface to the material utilised in preparing this volume, Sir Joseph states that the Ceylon collections in the Kew Herbarium are much richer than those in the Herbarium of the Royal Botanic Gardens, Peradeniya.

New Orchid Houses.—During the past year the Orchid Houses (Nos. XIII. and XIV.) have been entirely reconstructed. The old houses, which were erected in 1869, had proved quite unsuited to the cultivation of orchids according to modern practice; they were too lofty, and the plants in consequence too far removed from the glass. They were, in fact, almost useless except for the temporary exhibition of plants in flower, which had been grown in the orchid pits.

The woodwork of the houses had so far decayed that their reconstruction had become necessary. It was decided to carry this out on an entirely different plan. The mixed construction of wood and iron (or rather rolled steel) now generally employed at Kew was adopted. The tall central stage was abolished, and two parallel ranges, each 82 feet long and 12 feet wide, were erected on the site which had formerly been covered by a single span.

Each range is divided by a transverse partition into a warm (XIII.) and cooler portion (XIV.). The southern (left-hand) range has an ordinary stage on the left side, and a low bed on the right for large plants. In the warm portion (XIII.) will be found the species of *Dendrobium*, *Eria*, *Cattleya*, *Bulbophyllum* and *Stanhopea*, &c.: in the cooler (XIV.) those of *Cymbidium*, *Sobralia*, *Maxillaria*, *Epidendrum*, *Cœlogyne*, *Lælia*, &c. The northern (right hand) range has ordinary stages on both sides, that on the left being over a tank. The warm portion (XIII. A) is devoted to such genera as *Vanda*, *Aerides*, *Phalænopsis*, *Angræcum*, *Cypripedium* and *Anœctochilus*; the cool (XIV. A) to *Odontoglossum*, *Masdevallia*, *Oncidium*, *Lycaste*, &c.

These ranges, which are open to the public, now contain a large proportion of plants which are permanently cultivated in them. They still serve, as before, for the exhibition when in flower of those which require special cultural treatment in the orchid pits (XVI. C & D). These pits are connected with the exhibition houses by a glazed corridor, which also communicates with a new potting shed.

New Work Sheds.—No competent work can be accomplished without proper appliances. In these Kew has long been deficient. But potting and other cultural operations cannot ordinarily be

carried out in the houses in which the plants are exhibited. They require work sheds in which not merely will valuable plants suffer no injury, but the gardeners can work with convenience and comfort. It is impossible to get good work done with the best of workmen if there is a want of due regard to the health and reasonable requirements of those who have to use them. It is not, however, always easy to get funds for appliances which, however necessary, make no external show.

During the past year Her Majesty's Office of Works decided to remedy this state of things, or at any rate to make a vigorous commencement. The following important items have been disposed of :—

I. *Fernery Shed.*—This serves houses Nos. II. and III. and the adjoining pits. The reconstructed shed is 58 ft. long by 14 ft. 8 in. wide. The roof has been boarded, a concrete floor laid down, and it has been properly warmed and thoroughly lighted. It is continuous with the Filmy fern house, into which it opens.

II. *Propagating Shed and Packing Room.*—This has been reconstructed (50 ft. by 11 ft. 6 in.) on the same principles. Large consignments of plants from Indian and Colonial Botanic Gardens or from foreign correspondents can be handled on arrival without risking injury, and wardian cases for abroad can be kept at a proper temperature while awaiting despatch.

III. *Decorative Department Shed.*—This has also been reconstructed and enlarged (77 ft. by 11 ft. 6 in.) The work for which it was used had hitherto been conducted under great difficulty.

IV. *South Nursery Pit.*—This furnishes the supply of new plants for the Great Temperate House. It has been converted into an admirable span-roofed house 70 ft. long by 18 ft. wide.

Models of Fruits and Flowers from Amboina.—Through the kindness of Dr. Treub, the Director of the Botanic Garden, Buitenzorg, Java, we have recently been enabled to add many interesting specimens to the Museum Collections. Some examples of artificial fruits and miniature trees from Amboina, where they are said to be regular articles of commerce, are of special value. The fruits are formed of the pith of *Scævola Kœnigii*, Vahl, a shrub with succulent stems, distributed over Tropical E. Asia, Australia, and Polynesia; and the foliage is represented by feathers. The manufacture of these articles is not a modern introduction, as a reference to the *Herbarium Amboinense*, vol. iv., p. 117, will show. Rumphius there gives an interesting account of the uses of this plant. In *Hooker's Journal of Botany and Kew Garden Miscellany* (vol. iv., 1852, p. 349), the employment of this plant for the manufacture of artificial flowers is also referred to as being fully described by Rumphius before 1690.

American Golf Sticks.—The following report appeared in the United States Consular Reports (pp. 505–506) for the present year :—

"At the pretty village of Hoylake, a suburb of Liverpool, there are golf links which are famous as being the oldest and among the best in England, the game being brought here by the Scotch, who have settled in large numbers in this locality. For a number of years, golf sticks and other paraphernalia of the game made at Hoylake have been exported through this consulate to the United States. Quite recently, however, golf sticks made in the United States have been brought to England, and their arrival has aroused a great deal of comment. There is already a steadily growing trade in England for domestic wooden ware of United States manufacture, and I particularly mention washing tubs and washboards. There is undoubtedly a great opening in this market for American manufactures of wooden articles of almost every description, including furniture, which is dearer here than in the United States. There is no doubt that most American articles manufactured from wood are both cheaper and better made than similar articles manufactured in England. The reasons are that most woods are cheaper in America, and improved machinery is used to a far greater extent in the manufacture than here. The appearance of American-made golf sticks leads to the suggestion that the United States could even supply bats and wickets for the English national game of cricket cheaper and of better quality than the English-made articles. The following item is from the *Liverpool Echo* of February 1, 1898 :—

"'Most people will be surprised at the statement that we are now importing golf clubs from America ; but it is a fact, according to the statement of Mr. Charles S. Cox, an Englishman long resident in America, who, on his return home, has stated that he had no difficulty in obtaining orders for 8,000 clubs from the largest dealers in golf goods in Scotland and England. The reason for this is asserted to be that the American clubs are better made and better finished than those that can be obtained at home at anything like the same price. Mr. Cox says that the reason for this underselling is the improved machinery and advanced methods of manufacture which are used in America, compared with our own."

On enquiry, the following information was obtained :—

ARMY AND NAVY CO-OPERATIVE SOCIETY, LIMITED, to ROYAL GARDENS, KEW.

43, Johnson Street, Page Street,
Westminster, S.W., May 12, 1898.

DEAR SIR,

GOLF sticks, both square and turned, have been imported into England from America for some time. I have not heard that they are sending us complete clubs, and think this hardly likely, as the game is a new one for America, and they have had to get golf

club makers from Scotland to make their clubs. Until recently, they imported their complete clubs from Scotch makers.

The golf sticks would be second growth Hickory of the same description as the samples we sent you.

We are making a few golf heads of Hickory, but this wood is not generally liked; it is very hard, and does not give so good a grip of the ball as Beech.

I am, &c.,
(Signed) D. T. RUDDOCK,
Manager.

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1898.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1898.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a list of seeds of Hardy Herbaceous Annual and Perennial Plants and of Hardy Trees and Shrubs which, for the most part, have ripened at Kew during the year 1897. These seeds are not sold to the general public, but are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. No application, except from remote colonial possessions, can be entertained after the end of March.

HERBACEOUS PLANTS.

Acaena cylindrostachya, *Ruiz & Pav.*
macrostemon, *Hook. f.*
microphylla, *Hook. f.*
myriophylla, *Lindl.*
Novae Zealandiae, *Kirk.*
ovalifolia, *Ruiz & Pav.*
pinnatifida, *Ruiz & Pav.*
Sanguisorbae, *Vahl.*
sericea, *Jacq.*

Acanthus longifolius, *Poir.*
spinosus, *L.*

Achillea Ageratum, *L.*
compacta, *Willd.*
decolorans, *Schrad.*
filipendulina, *Lam.*

Achillea, *cont.*
leptophylla, *Bieb.*
ligustica, *All.*
Millefolium, *L.*
nobilis, *L.*
Ptarmica, *L.*
ptarmicoides, *Maxim.*
rupestris, *Huter.*
Santolina, *L.*
setacea, *Waldst. & Kit.*
taygetea, *Boiss. & Heldr.*
umbellata, *Sib. & Sm.*

Aconitum ferox, *Wall.*
heterophyllum, *Wall.*
Lycoctonum, *L.*
Napellus, *L.*

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Aconitum, *cont.*
Napellus var. album.
orientale, *Mill.*
palmatum, *D. Don.*
uncinatum, *L.*

Acroglochin chenopodioides, *Schrad.*

Actinolepis coronaria, *A. Gray.*

Actinomeris squarrosa, *Nutt.*

Adenophora Lamarckii, *Fisch.*
liliifolia, *Bess.*

Adlumia cirrhosa, *Rafin.*

Adonis aestivalis, *L.*
— var. squarrosa, *Stev.*
autumnalis, *L.*
pyrenaica, *DC.*

Aegopogon geminiflorus, *Humb. & Bonpl.*

Aethionema cappadocicum, *Spreng.*
coridifolium, *DC.*
saxatile, *R. Br.*

Aethusa Cynapium, *L.*

Agrimonia Eupatoria, *L.*
leucantha, *Kunze.*
odorata, *Mill.*

Agropyron acutum, *Roem. & Schult.*
Aucheri, *Boiss.*
caninum, *Beauv.*
dasyanthum, *Ledeb.*
desertorum, *Schult.*
divergens, *Nees.*
pungens, *Roem. & Schult.*
— var. pycnanthum, *Godr.*
repens, *Beauv.*
Richardsoni, *Schrad.*
tenerum, *Vasey.*

Agrostis alba, *L.*
— var. gigantea, *Roth.*
— var. stolonifera, (*L.*).
alpina, *Scop.*
nigra, *With.*
vulgaris, *With.*

Ajuga Chamaepitys, *Schreb.*

Alchemilla alpina, *L.*
conjuncta, *Bab.*
splendens, *Christ.*
vulgaris, *L.*
— var. hybrida.

Alisma Plantago, *L.*

Allium Ampeloprasum, *L.*
angulosum, *L.*
atropurpureum, *Waldst. & Kit.*
Babingtoni, *Borrer.*
bauerianum, *Baker.*
cardiostemon, *Fisch. & Mey.*
carinatum, *L.*
cyaneum, *Regel.*
Cydni, *Schott & Kotschy.*
fistulosum, *L.*
giganteum, *Regel.*
globosum, *Red.* var. albidum.
hirtifolium, *Boiss.*
hymenorrhizum, *Ledeb.*
karataviense, *Regel.*
Moly, *L.*
narcissiflorum, *Vill.*
nigrum, *L.*
odorum, *L.*
oreophilum, *C. A. Mey.*
orientale, *Boiss.*
polyphyllum, *Kar. & Kir.*
pulchellum, *Don.*
rosenbachianum, *Regel.*
roseum, *L.*
Schoenoprasum, *L.*
— var. sibiricum, (*L.*).
scorzoneræfolium, *Red.*
senescens, *L.*
sphaerocephalum, *L.*
subhirsutum, *L.*
subvillosum, *Salzm.*
Suworowi, *Regel.*
triquetrum, *L.*
ursinum, *L.*
Victorialis, *L.*

Alonzoa incisifolia, *Ruiz & Pav.*
Warscewiczii, *Regel.*

Alopecurus agrestis, *L.*
arundinaceus, *Poir.*
geniculatus, *L.*
pratensis, *L.*

Althaea cannabina, *L.* var. narbonensis, *Pourr.*
ficifolia, *Cav.*
Ludwigii, *L.*
rosea, *Cav.*
taurinensis, *DC.*

Alyssum argenteum, *Vitm.*
creticum, *L.*
gemonense, *L.*
grandiflorum, *Hort. Kew.*
incanum, *L.*
maritimum, *Lam.*
montanum, *L.*
podolicum, *Bess.*
saxatile, *L.*

Amaranthus caudatus, *L.*
hypochondriacus, *L.*
polygamus, *L.*
retroflexus, *L.*
speciosus, *Sims.*

Amethystea caerulea, *L.*

Ammophila arundinacea, *Host.*

Amsonia Tabernaemontana, *Walt.*

Anacyclus formosus, *Fenzl.*
radiatus, *Loisel.*

Anagallis arvensis, *L.*
— var. carnea, (*Schrank*).
— var. caerulea, (*Schreb.*).

Anarrhinum bellidifolium, *Desf.*

Anchusa capensis, *Thunb.*
officinalis, *L.*

Andropogon cirratus, *Hack.*
halepense, *Brot.*
provincialis, *Lam.*

Androsace nana, *Horn.*

Andryala ragusina, *L.*
varia, *Lowe.*

Anemone decapetala, *L.*
multifida, *Poir.*
nemorosa, *L.*
pennsylvanica, *L.*
Pulsatilla, *L.*
rivularis, *Buch-Ham.*
sylvestris, *L.*

Angelica dahurica, *Maxim.*

Anoda hastata, *Cav.*
Wrightii, *Gray.*

Antennaria dioica, *Gaertn.* var. tomentosa, *Hort.*

Anthemis arvensis, *L.*
Chia, *L.*
Cotula, *L.*
cupaniana, *Tod.*
montana, *L.*
nobilis, *L.*
— var. discoidalis, *Hort.*
tinctoria, *L.*
Triumfetti, *DC.*

Anthericum Liliago, *L.*
— var. algeriense, *B. & R.*
ramosum, *L.*

Anthoxanthum odoratum, *L.*
Puelii, *Lecoq & Lamotte.*

Anthyllis Vulneraria, *L.* var. Dillenii.

Antirrhinum Asarina, *L.*
majus, *L.*
Orontium, *L.*
rupestre, *Boiss. & Reut.*
siculum, *Mill.*

Apera interrupta, *Beauv.*

Aphanostephus arkansanus, *A. Gray.*

Apium graveolens, *L.*

Aplopappus rubiginosus, *Torr. & Gray.*

Aquilegia canadensis, *L.*
caerulea, *James.*
chrysantha, *A. Gray.*
glandulosa, *Fisch.*
sibirica, *Lam.*
vulgaris, *L.*

Arabis albida, *Stev.*
arenosa, *Scop.*
bellidifolia, *L.*
cebennenis, *DC.*
Holboellii, *Hornem.*
muralis, *Bert.* var. rosea, *DC.*
pumila, *Jacq.*

Arachis hypogaea, *L.*

Aralia cordata, *Thunb.*

Archangelica officinalis, *Hoffm.*

Arctium majus, *Bernh.*
— var. Kotschyi, *Hort.*
minus, *Bernh.*
nemorosum, *Lejeune.*

Arenaria balearica, *L.*
capillaris, *Poir.*
fasciculata, *Gouan.*
gothica, *Fries.*
graminifolia, *Schrad.*
— var. multiflora.
gypsophiloides, *L.*
montana, *L.*
pinifolia, *Bieb.*
purpurascens, *Ramond.*
serpyllifolia, *L.*
verna, *L.*

Argemone mexicana, *L.*
ochroleuca, *Sweet.*
platyceras, *Link & Otto.*

Armeria elongata *Hoffm.* var. californica.
juncea, *Girard.*
latifolia, *Willd.*
maritima, *Willd.*
— var. alba.
plantaginea, *Willd.*

Arnica Chamissonis, *Less.*
sachalinensis, *A. Gray.*

Arrhenatherum avenaceum, *Beauv.*

Artemisia Absinthium, *L.*
annua, *L.*
frigida, *Willd.*
parviflora, *Buch-Ham.*
pectinata, *Pall.*
stelleriana, *Bess.*

Arum italicum, *Mill.*

Asarum europaeum, *L.*

Asparagus officinalis, *L.*

Asperella hystrix, *Willd.*

Asperula azurea, *Jaub & Spach.*
galioides, *Bieb.*
tinctoria, *L.*

Asphodeline liburnica, *Reichb.*

Asphodelus albus, *Willd.*
fistulosus, *L.*

Aster acuminatus, *Michx.*
alpinus, *L.*
altaicus, *Willd.*
Amellus, *L.*
corymbosus, *Ait.*
Curtisii, *A. Gray.*
dahuricus, *Benth.*
glaucus, *Torr. & Gray.*
longifolius, *Lam.*
Novi-Belgii, *L.*
puniceus, *L.*
— var. lucidulus, Gray.
pyrenaeus, *DC.*
Radula, *Ait.*
scaber, *Thunb.*
sibiricus, *L.*
spectabilis, *Ait.*
tanacetifolius, *H. B. & K.*
trinervius, *Desf.*
umbellatus, *Mill.*
— var. latifolius.
Vahlii, *Hook. & Arn.*

Astilbe rivularis, *Buch-Ham.*
Thunbergii, *Miq.*

Astragalus alopecuroides, *L.*
alpinus, *L.*
boeticus, *L.*
chinensis, *L.*
chlorostachys, *Lindl.*
Cicer, *L.*
danicus, *Retz.* var albus.
frigidus, *A. Gray.*
glycyphyllus, *L.*
graecus, *Boiss.*
monspessulanus, *L.*
pentaglottis, *L.*
ponticus, *Pall.*
tibetanus, *Benth.*

Astrantia Biebersteinii, *Fisch. & Mey.*
major, *L.*
—var. carinthiaca, (*Hoppe.*)

Athamanta cretensis, *L.*
Matthioli, *Wulf.*

Atriplex hortensis, *L.*
— var. rubra, *Hort.*

Atropa Belladonna, *L.*

Aubrietia deltoidea, *DC.*
— var. grandiflora.
— var. Richardi, *Hort.*
gracilis, *Sprun.*

Avena distichophylla, *Vill.*
pubescens, *Huds.*
sativa, *L.*
sempervirens, *Vill.*

Baeria coronaria, *A. Gray.*
gracilis, *A. Gray.*

Ballota hispanica, *Benth.*

Baptisia australis, *R. Br.*

Barbarea vulgaris, *R. Br.*

Basella rubra, *L.*

Beckmannia erucaeformis, *Host*
— var. uniflorus, *Scrib.*

Beta maritima, *L.*
trigyna, *Waldst. & Kit.*
vulgaris, *L.*

Bidens cernua, *L.*
frondosa, *L.*
grandiflora, *Balb.*
leucantha, *Willd.*
tripartita, *L.*

Biscutella auriculata, *L.*
ciliata, *DC.*
didyma, *L.*

Blumenbachia insignis, *Schrad.*

Bocconia cordata, *Willd.*
microcarpa, *Maxim.*

Boltonia asteroides, *L'Herit.*
incisa, *Benth.*

Borago officinalis, *L.*

Bouteloua oligostachya, *Torr.*

Boykinia rotundifolia, *Parry.*

Brachypodium distachyum, *Beauv.*
pinnatum, *Beauv.*
sylvaticum, *R. & S.*

Brassica campestris, *L.*
— var. chinensis, (*L.*).
— var. glauca.

Brassica, *cont.*
Cheiranthos, *Vill.*
Erucastrum, *L.*
juncea, *Coss.*
oleracea, *L.*
Tournefortii, *Gouan.*

Briza media, *L.*
minor, *L.*

Brodiaea grandiflora, *Sm.*
lactea, *S. Wats.*
peduncularis, *S. Wats.*
uniflora, *Baker.*

Bromus adoënsis, *Hochst.*
albidus, *Bieb.*
asper, *Murr.*
breviaristatus, *Buckl.*
brizaeformis, *Fisch. & Mey.*
carinatus, *Hook. & Arn.*
ciliatus, *L.*
erectus, *Huds.*
inermis, *Leyss.*
Kalmii, *A. Gray.*
macrostachys, *Desf.*
madritensis, *L.*
maximus, *Desf.*
— var Gussonei, (*Parl.*).
mollis, *L.*
propendens, *Jord.*
racemosus, *L.*
sterilis, *L.*
Tacna, *Steud.*
tectorum, *L.*
unioloides, *H. B. & K.*

Browallia elata, *L.*
viscosa, *H. B. & K.*

Bryonia dioica, *Jacq.*

Bulbine annua, *Willd.*

Bulbinella Hookeri, *Benth. & Hook. f.*

Bunias orientalis, *L.*

Buphthalmum grandiflorum, *L.*
salicifolium, *L.*
speciosum, *Schreb.*

Bupleurum aureum, *Fisch.*
Candollei, *Wall.*
croceum, *Fenzl.*
longifolium, *L.*
protractum, *Hoffmg. & Lk.*
rotundifolium, *L.*

Butomus umbellatus, *L.*

Cakile maritima, *Scop.*

Calamagrostis confinis, *Nutt.*
dubia, *Bunge.*
epigeios, *Roth.*
lanceolata, *Roth.*
varia, *Beauv.*

Calamintha Acinos, *Clairv.*
chinensis, *Benth.*
Clinopodium, *Benth.*
grandiflora, *Moench.*
officinalis, *Moench.*
patavina, *Host.*

Calandrinia grandiflora, *Lindl.*
pilosiuscula, *DC.*
umbellata, *DC.*

Calceolaria mexicana, *Benth.*

Calendula arvensis, *L.*
officinalis, *L.*
suffruticosa, *Vahl.*

Callirhöe pedata, *A. Gray.*

Caltha palustris, *L.*

Camassia Cusickii, *S. Wats.*
esculenta, *Lindl.*
Fraseri, *Torr.*
Leichtlinii, *S. Wats.*

Camelina sativa, *Crantz.*

Campanula alliariaefolia, *Willd.*
barbata, *L.*
bononiensis, *L.*
carpatica, *Jacq.*
— var. alba.
cervicaria, *L.*
collina, *Bieb.*
colorata, *Wall.*
drabaefolia, *Sibth. & Sm.*
— var. alba.
— var. attica, (*Boiss. & Heldr.*).
Erinus, *L.*
excisa, *Schleich.*
glomerata, *L.*
lactiflora, *Bieb.*
latifolia, *L.*
— var. macrantha, (*Fisch.*).
— var. versicolor, (*Sibth. & Sm.*).
latiloba, *DC.*

Campanula, *cont.*
macrostyla, *Boiss.*
persicifolia, *L.*
— var. alba.
— var. maxima.
pulla, *L.*
punctata, *Lam.*
pyramidalis, *L.*
ramosissima, *Sibth. & Sm.*
rapunculoides, *L.*
reuteriana, *Boiss. & Bal.*
rhomboidalis, *L.*
rotundifolia, *L.*
Scheuchzeri, *Vill.*
sibirica, *L.*
— var. divergens, (*Willd.*).
specioso, *Pourr.*
spicata, *L.*
subpyrenaica, *Timb.*
thyrsoides, *L.*
Trachelium, *L.*

Cannabis sativa, L.

Carbenia benedicta, *Adans.*

Cardamine chenopodifolia, *Pers.*
graeca, *L.*
impatiens, *L.*

Carduus crispus, *L.*
— var. acanthoides, (*L.*).
stenolepis, *Benth.*
tenuiflorus, *Curt.*

Carex adusta, *Boott.*
alopecoidea, *Tuckerm.*
arenaria, *L.*
axillaris, *Good.*
binervis, *Sm.*
crinita, *Lam.*
Crus-corvi, *Shuttl.*
decomposita, *Muhl.*
depauperata, *Good.*
divulsa, *Good.*
flava, *L.*
— var. lepidocarpa, (*Tausch.*).
— var. Oederi, (*Ehrh.*).
— var. viridula.
fusca, *All.*
hirta, *L.*
hordeistichos, *Vill.*
leporina, *L.*
paniculata, *L.*
pendula, *Huds.*
punctata, *Gand.*

Carex, *cont.*
rariflora, *Sm.*
sparganioides, *Muhl.*
strigosa, *Huds.*
sylvatica, *Huds.*
teretiuscula, *Good.*
tribuloides, *Wahlenb.*
vulpina, *L.*
vulpinoidea, *Michx.*

Carthamus flavescens, *Willd.*
lanatus, *L.*
leucocaulos, *Sibth. & Sm.*
tinctorius, *L.*

Carum Carvi, *L.*
copticum, *Benth. & Hook. f.*
Petroselinum, *Benth. & Hook. f.*

Catananche caerulea, *L.*

Cedronella mexicana, *Benth.* var cana, *Hook.*

Celsia glandulosa, *Bouché.*
pontica, *Boiss.*

Cenchrus tribuloides, *L.*

Cenia turbinata, *Pers.*

Centaurea axillaris, *Willd.*
Crocodylium, *L.*
Cyanus, *L.*
cynaroides, *Link.*
diluta, *Dryand.*
eriophora, *L.*
Fontanesii, *Spach.*
glastifolia, *L.*
Jacea, *L.*
macrolopha, *Fenzl.*
melitensis, *L.*
montana, *L.*
— var. alba.
nervosa, *W.*
nigra, L.
nigrescens, *Willd.*
—var. vochinensis (*Bernh.*).
phrygia, *L.*
salmantica, *L.*
Scabiosa, *L.*
— var. olivieriana, (*DC.*).

Centranthus Calcitrapa, *Dufr.*
macrosiphon, *Boiss.*
ruber, *DC.*

Cephalaria alpina, *Schrad.*
leucantha, *Schrad.*
radiata, *Griseb. & Schenk.*
syriaca, *Schrad.*
tatarica, *Schrad.*
transsylvanica, *L*

Cerastium alpinum, *L.* var. lanatum, (*Lam.*).
— var. villosum, (*Baumg.*).
arvense, *L.*
— var. grandiflorum.
perfoliatum, *L.*
purpurascens, *Adams.*

Cerinthe alpina, *Kit.*
major, *L.*

Chaerophyllum aromaticum, *L.*
aureum, *L.*
temulum, *L.*

Charieis heterophylla, *Cass.*

Cheiranthus Cheiri, *L.*

Chelidonium majus, *L.*
— var. laciniatum.

Chelone nemorosa, *Dougl.*
obliqua, *L.*

Chenopodium album *L.*
ambrosoides, *L.*
Bonus-Henricus, *L.*
Botrys, *L.*
capitatum, *Aschers.*
ficifolium, *Sm.*
graveolens, *Willd.*
opulifolium, *Schrad.*
polyspermum, *L.*
Quinoa, *Willd.*
urbicum, *L.*
virgatum, *Thunb.*
Vulvaria, *L.*

Chionodoxa Luciliae, *Boiss.*
— var. sardensis.
— var. Tmolusii.

Chloris elegans, *H. B. & K.*

Chlorogalum pomeridianum, *Kunth.*

Chorizanthe membranacea, *Benth.*

Chorispora tenella, *DC.*

Chrysanthemum anserinaefolium, *Hausskn. & Bornm.*
Balsamita, *L.*
carneum, *Steud.*
caucasicum, *Pers.*
cinerariaefolium, *Vis.*
coccineum, *Willd.*
coronarium, *L.*
corymbosum, *L.*
lacustre, *Brot.*
Leucanthemum, *L.*
maximum, *Ramond.*
macrophyllum, *Waldst. & Kit.*
multicaule, *Desf.*
pallens, *J. Gay.*
Parthenium, *Bernh.*
praealtum, *Vent.*
segetum, *L.*
setabense, *Dufour.*

Chrysopogon avenaceus, *Benth.*
Gryllus, *Trin.*
nutans, *Benth.*

Cicer arietinum, *L.*

Cichorium Endivia, *L.*
Intybus, *L.*

Cimicifuga cordifolia, *Pursh.*
racemosa, *Nutt.*

Cineraria Saxifraga, *DC.*

Circaea lutetiana, *L.*

Citrullus vulgaris, *Schrad.*

Cladium germanicum, *Schrad.*

Clarkia elegans, *Dougl.*
pulchella, *Pursh.*
— var. alba.
rhomboidea, *Dougl.*

Claytonia perfoliata, *Donn.*
sibirica, *L.*

Cleome violacea, *L.*

Cleonia lusitanica, *L.*

Clypeola cyclodontea, *Delile.*

Cnicus altissimus, *Willd.*
canus, *Roth.*
Diacantha, *Desf.*

Cnicus, *cont.*
eriophorus, *Roth.*
monspessulanus, *L.*
ochroleucus, *Spreng*
oleraceus, *L.*
serrulatus, *Bieb.*
stellatus, *Roth.*
syriacus, *Roth.*
tataricus, *Willd.*

Cochlearia danica, *L.*
glastifolia, *L.*
officinalis, *L.*

Codonopsis ovata, *Benth.*

Coix Lacryma-Jobi, *L.*

Collinsia bartsiaefolia, *Benth.*
bicolor, *Benth.*
verna, *Nutt.*

Collomia coccinea, *Lehm.*
gilioides, *Benth.*
grandiflora, *Dougl.*
linearis, *Nutt.*

Commelina coelestis, *Willd.*

Conium maculatum, *L.*

Conringia orientalis, *Dum.*

Convolvulus pentapetaloides, *L.*
siculus, *L.*
tricolor, *L.*
undulatus, *Cav.*

Corchorus olitorius, *Willd.*

Coreopsis auriculata, *L.*
Drummondi, *Torr. & Gray*
grandiflora, *Nutt.*
lanceolata, *L.*
tinctoria, *Nutt.*
—var. atrosanguinea.

Coriandrum sativum, *L.*

Corispermum hyssopifolium, *L*

Coronilla atlantica, *Boiss. & Reut.*
cappadocica, *Willd.*
cretica, *L.*
vaginalis, *Lam.*
varia, *L.*

Corrigiola littoralis, *L.*

Cortusa Matthioli, *L.*

Corydalis capnoides, *Wahlenb.*
claviculata, *DC.*
glauca, *Pursh.*
lutea, *DC.*
racemosa, *Pers.*
sibirica, *Pers.*

Corynephorus canescens, *Beauv.*

Cosmidium burridgeanum, *Hort.*

Cosmos bipinnatus, *Cav.*

Cotula coronopifolia, *L.*

Cotyledon lusitanicus, *Lam.*

Cousinia uncinata, *Regel.*

Crambe hispanica, *L.*

Crassula glomerata, *Berg.*

Crepis aurea, *Reichb.*
blattarioides, *Vill.*
grandiflora, *Tausch.*
hyoseridifolia, *Reichb.*
paludosa, *Moench.*
rubra, *L.*
setosa, *Hall. f.*
sibirica, *L.*
tectorum, *L.*

Crocus biflorus, *Mill.*
cancellatus, *Herb.* var. cilicicus, *Maw.*
dalmaticus, *Vis.*
Imperati, *Tenore.*
medius, *Balb.*
Sieberi, *Gay.*
speciosus, *Bieb.*
susianus, *Ker-Gawl.*
tommasinianus, *Herb.*
vernus, *All.*
zonatus, *Gay.*

Crucianella aegyptiaca, *L.*

Cryptostemma calendulaceum, *R.Br.*

Cucubalus bacciferus, *L.*

Cucurbita Pepo, *L.*

Cuminum Cyminum, *L.*

Cuphea pinetorum, *Benth.*
Zimapani, *Morr.*

Cuscuta Epilinum, *Weihe.*
Epithymum, *Murr.*
europaea, *L.*

Cyclanthera explodens, *Naud.*

Cynara Scolymus, *L.*

Cynodon Dactylon, *Pers.*

Cynoglossum furcatum, *Wall.*
nervosum, *Benth.*
officinale, *L.*
petiolatum, *A. DC.*
pictum, *Ait.*

Cynosurus cristatus, *L.*

Cyperus esculentus, *L.*
longus, *L.*
vegetus, *Willd.*

Dactylis glomerata, *L.*

Dahlia coccinea, *Cav.*
variabilis, *Desf*

Dalea Lagopus, *Willd.*

Dasylirion texanum, *Scheele.*

Datura inermis, *Jacq.*
Stramonium, *L.*
Tatula, *L.*
— var gigantea.

Daucus Carota, *L.*
maritimus, *L.*
muricatus, *L.*
pusillus, *Michx.*

Delphinium Ajacis, *Reichb.*
cardiopetalum, *DC.*
cashmirianum, *Royle.*
caucasicum, *C. A. Mey.*
corymbosum, *Regel.*
elatum, *L.*
— var. alpinum, (*Waldst. & Kit.*)
— var. intermedium.
formosum, *Boiss. & Huet.*
grandiflorum, *L.*
hybridum, *Steph.*
maackianum, *Regel.*
Menziesii, *DC.*
nudicaule, *Torr. & Gray.*
olopetalum, *Boiss.*
orientale, *J. Gay.*
speciosum, *Bieb.*
— var. turkestanicum.

Delphinium, *cont.*
Staphisagria, *L.*
tomentosum, *Auch.*
vestitum, *Wall.*

Demazeria loliacea, *Nym.*
sicula, *Dum.*

Deschampsia caespitosa, *Beauv.*

Desmodium canadense, *DC.*

Deyeuxia
canadensis, *Munro.*
neglecta, *Kunth.*
sylvatica, *Kunth.*

Dianthus arenarius, *L.*
Armeria, *L.*
atrorubens, *All.*
barbatus, *L.*
— var. latifolius, (*Willd.*).
caesius, *Sm.*
capitatus, *DC.*
carthusianorum, *L.*
Caryophyllus, *L.*
chinensis, *L.*
ciliatus, *Guss.*
deltoides, *L.*
fragrans, *Bieb.*
furcatus, *Balb.*
giganteus, *Urv.*
hirtus, *Vill.*
monspessulanus, *L.*
petraeus, *Waldst. & Kit.*
plumarius, *L.*
Requienii, *Gren. & Godr.*

Dictamnus albus, *L.*
— var. purpureus.

Dierama pulcherrimum, *Baker.*

Digitalis ambigua, *Murr.*
ferruginea, *L.*
lanata, *Ehrh.*
lutea, *L.*
media, *Roth.*
orientalis, *Lam.*
purpurea, *L.*
Thapsi, *L.*

Dimorphotheca annua, *Less.*
hybrida, *DC.*
pluvialis, *Moench.*

Dipcadi serotinum, *Medic.*

Diplachne imbricata, *Scribner.*

Diplotaxis siifolia, *Kunze.*
tenuifolia, *DC.*

Dipsacus asper, *Wall.*
atratus, *Hook. f. & Thoms.*
ferox, *Loisel.*
fullonum, *L.*
japonicus, *Miq.*
laciniatus, *L.*
sylvestris, *Mill.*

Dischisma arenarium, *E. Mey.*

Dodecatheon Meadia, *L.* var. splendidum.

Doronicum glaciale, *Nym.*
scorpioides, *Lam.*

Dorycnium herbaceum, *Vill.*

Downingia elegans, *Torr.*

Draba aizoides, *L.*
Aizoon, *Wahlnb.*
altaica, *Bunge.*
arabisans, *Michx.*
carinthiaca, *Hoppe.*
frigida, *Saut.*
hirta, *L.*
hispida, *Willd.*
incana, *L.*
— var. stylaris.
Kotschyi, *Stur.*
lactea, *Adams.*
stellata, *Jacq.*

Dracocephalum grandiflorum, *L.*
Moldavica, *L.*
parviflorum, *Nutt.*
peregrinum, *L.*

Dryas octopetala, *L.*

Drypis spinosa, *L.*

Dulichium spathaceum, *Rich.*

Eatonia obtusata, *A. Gray.*

Ebenus Montbretii, *Jaub. & Spach.*

Ecballium Elaterium, *A. Rich.*

Eccremocarpus scaber, *Ruiz & Pav.*

Echinodorus ranunculoides, *Engelm.*

Echinops bannaticus, *Rochel.*
globifer, *Janka.*
Ritro, *L.*
sphaerocephalus, *L.*
— var. albidus, (*Boiss. & Sprun.*).

Echium plantagineum, *L.*
rosulatum, *Lange.*
vulgare, *L.*

Eclipta alba, *Hassk.*

Eleusine coracana, *Gaertn.*
stricta, *Roxb.*

Elsholtzia cristata, *Willd.*

Elymus arenarius, *L.*
canadensis, *L.*
— var. glaucifolius, *A. Gray.*
condensatus, *J. & C. Presl.*
giganteus, *Vahl.*
sibiricus, *L.*
virginicus, *L.*

Emilia flammea, *Cass.*

Encelia subaristata, *A. Gray.*

Epilobium angustifolium, *L.*
— var. alba.
billardierianum, *Ser.*
Dodonaei, *Vill.*
hirsutum, *L.*
Lamyi, *Schultz.*
linnaeoides, *Hook. f.*
luteum, *Pursh.*
montanum, *L.*
nummularifolium, *A. Cunn.*
rosmarinifolium, *Haenke.*
— var. sericeum.
tetragonum, *L.*
trigonum, *Schrank.*

Eragrostis minor, *Host.*
pectinacea, *Nees.*
pilosa, *L.*
Purshii, *Schrad.*
reptans, *Nees.*
tenuis, *A. Gray.*

Eranthis hyemalis, *Salisb.*

Eremostachys laciniata, *Bunge.*

Eremurus altaicus, *Stev.*
kaufmanniana, *Regel.*
robustus, *Regel.*
spectabilis, *Bieb.*

Erianthus fastigiatus, *Nees.*
strictus, *Baldw.*

Erigeron bellidifolius, *Muhl.*
compositus, *Pursh.*
glabellus, *Nutt.*
— var. asper.
macranthus, *Nutt.*
mucronatus, *DC.*
multiradiatus, *Benth. & Hook. f.*
philadelphicus, *L.*
speciosus, *DC.*
strigosus, *Muhl.*
uniflorus, *L.*

Erinus alpinus, *L.*
— var. albus.

Eriophorum angustifolium, *Roth.*

Erodium alsinefolium, *Delil.*
chium, *Willd.*
ciconium, *Willd.*
cicutarium, *L'Herit.*
gruinum, *Soland.*
hymenodes, *L'Herit.*
macradenum, *L'Herit.*
malacoides, *Willd.*
Salzmanni, *Del.*
Semenovii, *Regel.*
serotinum, *Stev.*
trichomanefolium, *L'Herit*
tmoleum, *Reut.*

Eruca sativa, *Mill.*

Eryngium alpinum, *L.*
amethystinum, *L.*
Bourgati, *Gouan.*
bromeliæfolium, *Delar.*
campestre, *L.*
giganteum, *Bieb.*
maritimum, *L.*
oliverianum, *Delar.*
planum, *L.*
triquetrum, *Vahl.*

Erysimum asperum, *DC*
boryanum, *Boiss.*
hieracifolium, *L.*

Erysimum, *cont.*
marshallianum, *Andrz.*
perowskianum, *Fisch. & Mey.*

Erythraea Centaurium, *Pers.*
ramosissima, *Pers.*

Eschscholzia californica, *Cham.*
— var. caespitosa, *Brewer.*

Eucharidium concinnum, *Fisch. & Mey.*
— var. grandiflorum.

Euchlaena mexicana, *Schrad.*

Eupatorium ageratoides, *L.*
cannabinum, *L.*
purpureum, *L.*
serotinum, *Michx.*
sessilifolium, *L.*

Euphorbia coralloides, *L.*
dentata, *Michx.*
exigua, *L.*
hierosolymitana, *Boiss.*
Lagascae, *Spreng.*
Lathyris, *L.*
medicaginea, *Boiss.*
Myrsinites, *L.*
palustris, *L.*
Peplis, *L.*
pilosa, *L.*
portlandica, *L.*
segetalis, *L.*
stricta, *L.*
virgata, *Waldst. & Kit.*

Fedia Cornucopiae, *Gaertn.*

Felicia fragilis, *Cass.*

Ferula communis, *L.*
Ferulago, *L.*
glauca, *L.*
— var. candelabra, *Heldr.*
Narthex, *Boiss.*
nodiflora, *L.*
tingitana, *L.*

Festuca arundinacea, *Vill.*
bromoides, *L.*
capillifolia, *Dufour.*
delicatula, *Lag.*
duriuscula, *L.*
— var. crassifolia, *Gaud.*
elatior, *L.*
— var. pratensis, (*Huds*).

Festuca, *cont.*
gigantea, *Vill.*
Halleri, *All.*
heterophylla, *Lam.*
montana, *Steud.* var. altissima, (*Boiss.*)
Myuros, *L.*
panciciana, *Hack.*
Poa, *Kunth.*
rigida, *Kunth.*
scoparia, *Kern.*

Foeniculum vulgare, *Mill.*

Fragaria indica, *Andr.*

Fritillaria acmopetala, *Boiss.*
armena, *Boiss.*
citrina, *Baker.*
imperialis, *L.*
kotschyana, *Herb.*
lutea, *Mill.*
Meleagris, *L.*
Whittallii, *Baker.*

Fumaria anatolica, *Boiss.*
officinalis, *L.*

Funkia ovata, *Spreng.*
sieboldiana, *Hook.*

Gaillardia aristata, *Pursh.*

Galanthus Elwesii, *Hook. f.*

Galega officinalis, *L,*
orientalis, *Lam.*

Galinsoga brachystephana, *Regel.*
parviflora, *Cav.*

Galium boreale, *L.*
Mollugo, *L.*
recurvum, *Req.*
tenuissimum, *Bieb.*
tricorne, *Stokes.*

Gastridium australe, *Beauv.*

Gaudinia fragilis, *Beauv.*

Gaura parviflora, *Dougl.*

Gentiana asclepiadea, *L.*
— var. alba.
cruciata, *L.*
lutea, *L.*
septemfida, *Pall.*
tibetica, *King.*

Geranium albanum, *Bieb.*
anemonaefolium, *L'Herit.*
armenum, *Boiss.*
bohemicum, *L.*
collinum, *Steph.*
Endressi, *Gay.*
eriostemon, *Fisch.*
ibericum, *Cav.*
Londesii, *Fisch.*
lucidum, *L.*
nodosum, *L.*
palustre, *L.*
pratense, *L.*
pusillum, *Burm. f.*
pyrenaicum, *Burm. f.*
Richardsoni, *Fisch. & Trautv.*
rivulare, *Vill.*
sanguineum, *L.*
sylvaticum, *L.*
wallichianum, *G. Don.*
Wilfordi, *Maxim.*
wlassovianum, *Fisch.*

Gerbera Bellidiastrum, *Benth.*
kunzeana, *A. Br. & Asch.*
nivea, *Sch. Bip.*

Geum chiloense, *Balb.*
hispidum, *Fries*
inclinatum, *Schleich.*
macrophyllum, *Willd.*
montanum, *L.*
parviflorum, *Sm.*
pyrenaicum, *Mill.*
rivale, *L.*
strictum, *Ait.*
triflorum, *Pursh.*
tyrolense, *Kern.*
urbanum, *L.*

Gilia achilleaefolia, *Benth.*
androsacea, *Steud.*
— var. rosea.
capitata, *Sims.*
densiflora, *Benth.*
dianthoides, *Endl.*
inconspicua, *Dougl.*
laciniata, *Ruiz & Pav.*
liniflora, *Benth.*
micrantha, *Steud.*
squarrosa, *Hook. & Arn.*
tricolor, *Benth.*

Gillenia trifoliata, *Moench.*

Gladiolus anatolicus, *Hort.*
atroviolaceus, *Boiss.*
segetum, *Ker-Gawl.*

Glaucium corniculatum, *Curt.*
— var. rubrum, *Hort.*
flavum, *Crantz.* var. fulvum, (*Sm.*)
leptopodum, *Maxim.*

Globularia trichosantha, *Fisch. & Mey.*
vulgaris, *L.*

Glyceria aquatica, *Sm.*
maritima, *Mert. & Koch.*

Glycine Soja, *Sieb. & Zucc.*

Glycyrrhiza echinata, *L.*

Gnaphalium indicum, *L.*
luteo-album, *L.*

Gratiola officinalis, *L.*
— var. minor.

Grindelia glutinosa, *Dunal.*
inuloides, *Willd.*
squarrosa, *Dunal.*

Guizotia abyssinica, *Cass.*

Gunnera chilensis, *Lam.*
manicata, *Linden.*

Gypsophila muralis, *L.*
paniculata, *L.*
Rokejeka, *Delile.*
Steveni, *Fisch.*

Hablitzia tamnoides, *Bieb.*

Hastingia alba, *S. Wats.*

Hebenstreitia tenuifolia, *Schrad.*

Hedysarum boreale, *Nutt.*
coronarium, *L.*
esculentum, *Ledeb.*
flexuosum, *L.*
microcalyx, *Baker.*
neglectum, *Ledeb.*
obscurum, *L.*
Pestalozzae, *Boiss.*
spinosissimum, *L.*

Helenium autumnale, *L.* var. pumilum, (*Willd.*).
Bolanderi, *A. Gray.*

Helenium, *cont.*
Hoopesii, *A. Gray.*
quadridentatum, *Labill.*
tenuifolium, *Nutt.*

Helianthus annuus, *L.*
argophyllus, *Torr. & Gray.*
debilis, *Nutt.*
laetiflorus, *Pursh.*

Helichrysum bracteatum, *Andr.*
grandiflorum, *D. Don.*
lanatum, *DC.*
plicatum, *DC.*
serotinum, *Boiss.*

Heliophila amplexicaulis, *L. f.*
crithmifolia, *Willd.*

Heliopsis laevis, *Pers.*

Heliotropium europaeum, *L.*

Helipterum humboldtianum, *DC.*
Manglesii, *F. Muell.*
roseum, *Benth.*

Helleborus colchicus, *Regel.*
orientalis, *Lam.*
— var. roseus.

Helonias bullata, *L.*
— var. latifolia.

Hemerocallis flava, *L.*
fulva, *L.*
— var. Kwanso, *Regel.*

Heracleum asperum, *Bieb.*
gummiferum, *Willd.*
lanatum, *Michx.*
pyrenaicum, *Lam.*
Sphondylium, *L.*
villosum, *Fisch.*

Herniaria glabra, *L.*
hirsuta, *L.*

Hesperis matronalis, *L.*

Heterotheca Lamarckii, *Cass.*

Heuchera cylindrica, *Dougl.*
Drummondi, *Hort.*
glabra, *Willd.*
pilosissima, *Fisch. & Mey.*
sanguinea, *Engelm.*

Hibiscus esculentus, *L.*
Trionum, *L.*

Hieracium alpinum, *L.*
amplexicaule, *L.*
aurantiacum, *L.*
bupleuroides, *C. C. Gmel.*
corymbosum, *Fries.*
crocatum, *Fries.*
Dewari, *Boswell.*
glaucum, *All.*
gymnocephalum, *Griseb.*
Jankae, *Uechtritz.*
juranum, *Fries.*
lanatum, *Waldst. & Kit.*
lactucaefolium, *Arv. Touv.*
murorum, *L.* var. integrifolium, (*Lange*).
norvegicum, *Fries.*
pallidum, *Biv.*
pannosum, *Boiss.*
pratense, *Tausch.*
pulmonarioides, *Vill.*
rigidum, *Hartm.*
rupestre, *All.*
stoloniflorum, *Waldst. & Kit.*
umbellatum, *L.*
villosum, *Jacq.*
vulgatum, *Fries.*

Hilaria cenchroides, *H. B. & K.*
Jamesii, *Benth.*
rigida, *Vasey.*

Hippocrepis multisiliquosa, *L.*

Hippuris vulgaris, *L.*

Holcus lanatus, *L.*

Hordeum adscendens, *H.B. & K.*
bulbosum, *L.*
jubatum, *L.*
maritimum, *With.*
murinum, *L.*
secalinum, *Schreb.*

Horminum pyrenaicum, *L.*

Hosackia purshiana, *Benth.*
subpinnata, *G. Don.*

Humulus japonicus, *Sieb. & Zucc.*
— var. variegatus.

Hunnemannia fumariaefolia, *Sweet.*

Hyacinthus amethystinus, *L.*
romanus, *L.*

Hydrocotyle repanda, *Pers.*

Hydrophyllum canadense, *L.*
virginicum, *L.*

Hyoscyamus aureus, *L.*
niger, *L.*
—var. albus, *Hort.*

Hypecoum grandiflorum, *Benth.*
procumbens, *L.*

Hypericum atomarium, *Boiss.*
Gebleri, *C. A. Mey.*
montanum, *L.*
olympicum, *L.*
orientale, *L.* var. decussatum, (Kunze).
perforatum, *L.*
pyramidatum, *Ait.*
rhodopeum, *Friv.*
tetrapterum, *Fries.*
tomentosum, *L.*

Hypochoeris glabra, *L.*

Hyssopus officinalis, *L.*
—var. aristatum, (*Jord.*).

Iberis amara, *L.*
pectinata, *Boiss.*
umbellata, *L.*
—var. carnea.

Impatiens amphorata, *Edgw.*
balsamina, *L.*
fulva, *Nutt.*
parviflora, *DC.*
Roylei, *Walp.*
scabrida, *DC.*

Inula barbata, *Wall.*
bifrons, *L.*
Conyza, *DC.*
ensifolia, *L.*
glandulosa, *Puschk.*
grandiflora, *Willd.*
Helenium, *L.*
hirta, *L.*
Hookeri, *C. B. Clarke.*
salicina, *L.*
thapsoides, *Spreng.*

Ionopsidium acaule, *Reichb.*
albiflorum, *Dur.*

Ipomoea purpurea, *Lam.*
sinuata, *Orteg.*

Iris foetidissima, *L.*
graminea, *L.*
—var. latifolia, *Spach.*
missouriensis, *Nutt.*
Pseudacorus, *L.*
setosa, *Pall.*
sibirica, *L.*
spuria, *L.*
—var. notha, (*Bieb.*).

Isatis glauca, *Auch.*
tinctoria, *L.*
Villarsii, *Gaud.*

Isopyrum fumarioides, *L.*

Iva xanthifolia, *Nutt.*

Jasione montana, *L.*
perennis, *Lam.*

Jasonia tuberosa, *L.*

Juncus alpinus, *Vill.*
balticus, *Willd.*
bufonius, *L.*
Chamissonis, *Kunth.*
compressus, *Jacq.*
effusus, *L.*
glaucus, *Sibth.*
lamprocarpus, *Ehrh.*
maritimus, *Lam.*
obtusiflorus, *Ehrh.*
squarrosus, *L.*
tenuis, *Willd.*

Jurinea cyanoides, *DC.*

Kitaibelia vitifolia, *Willd.*

Koeleria albescens, *DC.*
cristata, *Pers.*
phleoides, *Pers.*
setacea, *Pers.* var. valesiaca (*Gaud.*).

Lactuca brevirostris, *Champ.*
muralis, *E. Mey.*
perennis, *L.*
Plumieri, *Gren. & Godr.*
saligna, *L.*
Scariola, *L.*
virosa, *L.*

Lagenaria vulgaris, *Ser.*

Lallemantia canescens, *Fisch. & Mey.*
iberica, *Fisch. & Mey.*
peltata, *Fisch. & Mey.*

Lamarckia aurea, *Moench.*

Lapsana communis, *L.*

Lasiospermum radiatum, *Trevir.*

Lasthenia glabrata, *Lindl.*

Lathraea Squamaria, *L.*

Lathyrus angulatus, *L.*
Aphaca, *L.*
articulatus, *L.*
Cicera, *L.*
Clymenum, *L.*
filiformis, *Gay.*
latifolius, *L.*
—var. ensifolius, (*Badaro*).
laetiflorus, *Greene.*
macrorrhizus, *Wimm.*
maritimus, *Bigel.*
— var. acutifolius.
montanus, *Bernh.*
niger, *Bernh.*
Nissolia, *L.*
Ochrus, *DC.*
pannonicus, *Garcke* var. varius.
rotundifolius, *Willd.*
sativus, *L.*
sessilifolius, *Hort. Kew.*
sphaericus, *Retz.*
sylvestris, *L.*
tingitanus, *L*
tuberosus, *L.*
venosus, *Muhl.*

Lavatera cachemiriana, *Cambess.*
Olbia, *L.*
thuringiaca, *L.*
trimestris, *L.*

Layia elegans, *Torr. & Gray.*
glandulosa, *Hook. & Arn.*
platyglossa, *A. Gray.*

Lens esculenta, *Moench.*

Leontodon asperrimus, *Boiss.*
autumnalis, *L.*
crispus, *Vill.*
Ehrenbergii, *Hort. Kew.*
hastilis, *L.*

Leontopodium alpinum, *Cass.*

Leonurus Cardiaca, *L.*
sibiricus, *L.*

Lepidium Draba, *L.*
graminifolium, *L.*
incisum, *Roth.*
latifolium, *L.*
Menziesii, *DC.*
sativum, *L.*
virginicum, *L.*

Leptosyne Douglasii, *DC.*
maritima, *A. Gray.*

Lepturus cylindricus, *Trin.*

Leucojum vernum, *L.*

Leuzea conifera, *DC.*

Levisticum officinale, *Koch.* var. variegatum.

Liatris scariosa, *Willd.*
spicata, *Willd.*
— var. montana, *A. Gray.*

Ligusticum alatum, *Spreng.*
pyrenaicum, *Gouan.*
scoticum, *L.*
Seguieri, *Koch.*
Thomsoni, *C. B. Clarke.*

Limnanthes alba, *Hartw.*

Linaria albifrons, *Spreng.*
alpina, *Mill.*
anticaria, *Boiss. & Reut.*
bipartita, *Willd.*
Broussonetii, *Char.*
dalmatica, *Mill.*
genistifolia, *Mill.*
heterophylla, *Desf.*
hirta, *Moench.*
maroccana, *Hook. f.*
minor, *Desf.*
multipunctata, *Hoffmgg. & Link.*
peloponnesiaca, *Boiss. & Heldr.*
purpurea, *L.*
reticulata, *Desf.*
— var. purpurea.
sapphyrina, *Hoffmg. & Lk.*
saxatilis, *Hoffmgg. & Link.*
spartea, *Hoffmgg. & Link.*
striata, *DC.*

Linaria, *cont.*
triphylla, *Mill.*
tristis, *Mill.*
vulgaris, *Mill.*

Lindelophia spectabilis, *Lehm.*

Lindheimera texana, *A. Gray.*

Linum grandiflorum, *Desf.*
— var. coccineum.
monogynum, *Forst.*
nervosum, *Waldst. & Kit.*
perenne, *L.*
usitatissimum, *L.*

Lithospermum latifolium, *Michx.*
officinale, *L.*

Loasa muralis, *Griseb.*
vulcanica, *André.*

Lobelia cardinalis, *L.*
Erinus, *L.*
syphilitica, *L.*
tenuior, *R. Br.*
triquetra, *L.*

Lolium multiflorum, *Lam.*
perenne, *L.*

Lonas inodora, *Gaertn.*

Lopezia coronata, *Andr.*

Lotus corniculatus, *L.*
major, *Scop.*
ornithopodioides, *L.*
siliquosus, *L.*
tenuis, *Waldst. & Kit.*
Tetragonolobus, *L.*

Lunaria annua, *L.*
rediviva, *L.*

Lupinus affinis, *Agardh.*
angustifolius, *L.*
arboreus, *Sims.*
Cosentini, *Guss.*
densiflorus, *Benth.*
elegans, *H. B. & K.*
micranthus, *Dougl.*
mutabilis, *Sw.*
polyphyllus, *Lindl.*
pubescens, *Benth.*
pulchellus, *Sweet.*
tricolor, *Hort.*

Luzula campestris, *DC.*
maxima, *DC.*
nivea, *DC.*

Lychnis alpina, *Mill.*
chalcedonica, *L.*
Coeli-rosea, *Backh.*
— var. elegans, *Hort.*
coronaria, *Desr.*
— var. oculata.
dioica, *L.*
Flos-cuculi, *L.*
fulgens, *Fisch.*
Githago, *Scop.*
haageana, *Lemaire.*
Lagascae, *Hook. f.*
pyrenaica, *Berger.*
Viscaria, *L.*

Lycopersicum esculentum, *Mill.*

Lycopus europaeus, *L.*

Lycurus phleoides, *H. B. & K.*

Lysimachia atropurpurea, *L.*
barystachys, *Bunge.*
ciliata, *L.*
clethroides, *Duby.*
davurica, *Ledeb.*
vulgaris, *L.*

Lythrum Graefferi, *Tenore.*
Salicaria, *L.*
— var. rosea.

Màdia elegans, *D. Don.*
sativa, *Molina.*

Malcolmia africana, *R. Br*
maritima, *R. Br.*

Malope trifida, *Cav.*

Malva Alcea, *L.*
crispa, *L.*
Duriaei, *Hort. Kew.*
moschata, *L.*
oxyloba, *Boiss.*
parviflora, *L.*
rotundifolia, *L.*
sylvestris, *L.*

Malvastrum limense, *Ball.*

Mandragora officinarum, *L.*

Marrubium astracanicum, *Jacq.*
pannonicum, *Reichb.*
vulgare, *L.*

Martynia fragrans, *Lindl.*

Matricaria glabra, *Ball.*
inodora, *L.*
— var. discoidea, (*DC.*).
Tchihatchewii, *Hort. Kew.*

Matthiola incana, *R. Br.*
sinuata, *R. Br.*
tricuspidata, *R. Br.*

Meconopsis cambrica, *Vig.*
Wallichi, *Hook*

Medicago apiculata, *Willd.*
hispida, *Gaertn.*
littoralis, *Rhode.*
lupulina, *L.*
maculata, *Sibth.*
marina, *L.*
minima, *L.*
Murex, *Willd.*
orbicularis, *All.*
sativa, *L.*
scutellata, *All.*
tuberculata, *Willd.*

Melica altissima, *L.*
ciliata, *L.*
— var. penicillaris, (*Boiss. & Bal.*).
glauca, *F. Schultz* var. nebrodensis, (*Parl.*).
nutans, *L.*
uniflora, *Retz.*

Melilotus alba, *Desr.*
indica, *All.*
officinalis, *Lam.*

Melissa officinalis, *L.*

Mentha Puleguim, *L.*
sylvestris, *L.* var. candicans, (*Mill.*).
viridis, *L.*

Mercurialis annua, *L.*

Mesembryanthemum pomeridianum, *L.*
pyropeum, *Haw.*

Mimulus cardinalis, *Dougl.*
cupreus, *Regel.*
luteus, *L.*

Mirabilis divaricata, *Lowe.*
Jalapa, *L.*
longiflora, *L.*

Modiola multifida, *Moench.*

Molinia caerulea, *Moench.*

Molopospermum cicutarium, *DC.*

Momordica Charantia, *L.*

Monolepis trifida, *Schrad.*

Moricandia arvensis, *DC.*

Moscharia pinnatifida. *Ruiz & Pav.*

Muehlenbergia glomerata, *Trin.*
mexicana *Trin.*
sylvatica, *Torr. & Gray.*
Willdenovii, *Trin.*

Muscari Argaei, *Hort.*
armeniacum, *Baker.*
atlanticum, *Boiss. & Reut.*
comosum, *Mill.*
Heldreichii, *Boiss.*
moschatum, *Willd.*
neglectum, *Guss.*
racemosum, *Mill.*
szovitsianum, *Baker.*

Myosotis arvensis, *Lam.*
collina, *Hoffm.*
dissitiflora, *Baker.*
palustris, *Lam.*

Myosurus minimus, *L.*

Myriactis nepalensis, *Less.*

Myrrhis odorata. *Scop.*

Nardus stricta, *L.*

Nemesia floribunda, *Lehm.*
pubescens, *Benth.*
versicolor, *E. Mey.*

Nemophila aurita, *Lindl.*
insignis, *Dougl.*
maculata, *Benth.*
Menziesii, *Hook. & Arn.*
parviflora, *Dougl.*

Nepeta azurea, *R. Br.*
Cataria, *L.*
concolor, *Boiss. & Heldr.*
macrantha, *Fisch.*
Mussini, *Spreng.*
Nepetella, *L.*
nuda, *L.*

Nepeta, *cont.*
spicata, *Benth.*
suavis, *Stapf.*

Nicandra physaloides, *Gaertn.*

Nicotiana acuminata, *Hook.*
alata, *Link & Otto.*
Langsdorffii, *Schrank.*
paniculata, *L.*
rustica, *L.*
Tabacum, *L.*

Nigella damascena, *L.*
hispanica, *L.*
orientalis, *L.*
sativa *L.*

Nolana prostrata, *L.*

Nothoscordum fragrans, *Kunth.*

Ocimum canum, *Sims.*

Oenanthe crocata, *L.*
Lachenali, *C. C. Gmelin.*
peucedanifolia, *Pollich.*
pimpinelloides, *L.*
silaifolia, *Bieb.*
— var. australis, *Wulf.*

Oenothera amoena, *Lehm.*
berteriana, *Spach.*
biennis, *L.*
— var. grandiflora, *Torr. & Gray.*
bistorta, *Nutt.*
densiflora, *Lindl.*
dentata, *Cav.*
fruticosa, *L.*
— var. Youngii, *Hort.*
glauca, *Michx.*
odorata, *Jacq.*
pumila, *L.*
riparia, *Nutt.*
rosea, *Ait.*
speciosa, *Nutt.*
tenella, *Cav.*
tetraptera, *Cav.*

Omphalodes linifolia, *Moench.*

Onobrychis lasiostachya, *Boiss.*
Pallasii, *Bieb.*
sativa, *Lam.*

Ononis arvensis, *L.*
rotundifolia, *L.*
spinosa, *L.*

Onopordon Acanthium, *L.*
sibthorpianum, *Boiss.*

Opoponax Chironium, *Koch.*

Orchis foliosa, *Soland.*
incarnata, *L.*
latifolia, *L.*
maculata, *L.*

Origanum vulgare, *L.*

Ornithogalum arcuatum, *Stev.*
exscapum, *Tenore.*
fimbriatum, *Willd.*
narbonense, *L.*
nutans, *L.*
orthophyllum, *Tenore.*

Ornithopus perpusillus, *L.*
sativus, *Brot.*

Orobanche Hederae, *Duby.*
minor, *Sutt.*
ramosa, *L.*

Oxalis corniculata, *L.*
— var. atropurpurea.

Oxybaphus nyctagineus, *Sweet.*

Oxytropis campestris, *DC.*
ochroleuca, *Bunge.*
pilosa, *DC.*

Palaua dissecta, *Benth.*

Pallenis spinosa, *Cass.*

Panicum bulbosum, *H. B. & K.*
capillare, *L.*
colonum, *L.*
Crus-galli, *L.*
Isachne, *Roth.*
miliaceum, *L.*
obtusum, *H. B. & K.*
sanguinale, *L.*
texanum, *Vasey.*
virgatum, *L.*

Papaver aculeatum, *Thunb.*
alpinum, *L.* var. roseum.
apulum, *Tenore.*
Argemone, *L.*
dubium, *L.*
glaucum, *Boiss. & Hausskn.*
laevigatum, *Bieb.*
lateritium, *C. Koch.*
nudicaule, *L.*

Papaver, *cont.*
orientale, *L.*
— var. bracteatum, (*Lindl.*).
pavoninum, *Mey.*
pilosum, *Sibth. & Sm.*
Rhoeas, *L.*
— var. latifolium, *Prain.*
rupifragum, *Boiss. & Reut.*
— var. atlanticum, *Ball.*
somniferum, *L.*
strictum, *Boiss.*

Pappophorum alopecuroideum, *Vahl.*

Paracaryum heliocarpum, *Kern.*

Paradisia Liliastrum, *Bertol.*

Parietaria officinalis, *L.*

Parnassia nubicola, *Wall.*
palustris, *L.*

Parochetus communis, *Buch-Ham.*

Paspalum dilatatum, *Poir.*
pubiflorum, *Rupr.* var. glabrum.
virgatum, *L.*

Peganum Harmala, *L.*

Peltaria angustifolia, *DC.*

Pennisetum cenchroides, *Rich.*
typhoideum, *Rich.*
villosum, *R. Br.*

Pentstemon barbatus, *Roth.*
campanulatus, *Willd.*
confertus, *Dougl.*
diffusus, *Dougl.*
glandulosus, *Dougl.*
glaucus, *Grah.* var. stenosepalus, *A. Gray.*
Hartwegii, *Benth.*
laevigatus, *Soland.* var. Digitalus, *A. Gray.*

Petunia nyctaginiflora, *Juss.*

Peucedanum aegopodioides, *Vandas.*
coriaceum, *Reichb. f.*
gallicum, *Latour.*
graveolens, *Benth.*
sativum, *Benth. & Hook. f.*

Peucedanum, *cont.*
Sowa, *Kurz.*
verticillare, *Spreng.*

Phacelia bipinnatifolia, *Michx.*
campanularia, *A. Gray.*
divaricata, *A. Gray.*
hispida, *A. Gray.*
loasaefolia, *Torr.*
Parryi, *Torr.*
tanacetifolia, *Benth.*
viscida, *Torr.*
Whitlavia, *A. Gray.*

Phaecasium lampsanoides, *Cass.*

Phaenosperma globosa, *Munro.*

Phalaris arundinacea, *L.*
canariensis, *L.*
intermedia, *Box.*
paradoxa, *L.*
tuberosa, *L.*

Phaseolus aconitifolius, *Jacq.*
multiflorus, *Willd.*
Mungo, *L.*
pilosus, *H. B. & K.*
ricciardianus, *Tenore.*
tuberosus, *Lour.*
vulgaris, *L.*

Phelypaea coccinea, *Poir.*

Phleum asperum, *Jacq.*
Boehmeri, *Wibel.*
pratense, *L.*

Phlomis agraria, *Bunge.*
armeniaca, *Willd.*
lunariifolia, *Sibth. & Sm.*
setigera, *Falc.*
tuberosa, *L.*
umbrosa, *Turcz.*
viscosa, Poir.

Physalis Alkekengii, *L.*
Francheti, *Mast.*
peruviana, *L.*

Physochlaina orientalis, *G. Don.*

Physostegia virginiana, *Benth.*
— var. speciosa, *A. Gray.*

Phyteuma canescens, *Waldst. & Kit.*
Halleri, *All.*

Phyteuma, *cont.*
orbiculare, *L.*
Scheuchzeri, *All.*
spicatum, *L.*

Phytolacca acinosa, *Roxb.*
icosandra, *L.*
octandra, *L.*

Picridium tingitanum, *Desf.*

Picris echioides, *L.*
hieracioides, *L.*

Pimpinella Anisum, *L.*
magna, *L.*

Pisum arvense, *L.*
elatius, *Bieb.*
sativum, *L.*

Plantago arenaria, *Waldst. & Kit.*
Candollei, *Rafin.*
Coronopus, *L.*
Cynops, *L.*
Lagopus, *L.*
lanceolata, *L.*
major, *L.*
— var. rubra.
maritima, *L.*
media, *L.*
Oreades, *Decne.*
ovata, *Forsk.*
patagonica, *Jacq.*

Platycodon grandiflorum, *A.DC.*

Platystemon californicus, *Benth.*

Pleurospermum angelicoides, *Benth.*
pulchrum, *Aitch. & Hemsl.*

Plumbago micrantha, *Ledeb.*

Poa abyssinica, *Jacq.*
alpina, *L.*
— var. badensis, (*Haenke*).
arachnifera, *Torr.*
caesia, *Sm.*
Chaixii, *Vill.*
chinensis, *L.*
compressa, *L.*
nemoralis, *L.*
nevadensis, *Vasey.*
palustris, *Roth.*
pratensis, *L.*
trivialis, *L.*
violacea, *Bell.*

Podolepis acuminata, *R. Br.*

Podophyllum Emodi, *Wall.*

Polemonium caeruleum, *L.*
flavum, *Greene.*
himalayanum, *Baker.*
mexicanum, *Cerv.*
pauciflorum, *S. Wats.*
reptans, *L.*

Polygonatum biflorum, *Ell.*
verticillatum, *All.*

Polygonum alpinum, *All.*
aviculare, *L.*
Bistorta, *L.*
capitatum, *Buch-Ham.*
cilinode, *Michx.*
compactum, *Hook. f.*
Convolvulus, *L.*
orientale, *L.*
viviparum, *L.*
Weyrichii, *F. Schmidt.*

Polypogon monspeliensis, *Desf.*

Polypteris texana, *A. Gray.*

Portulaca grandiflora, *Hook.*

Potentilla alchemilloides, *Lapeyr.*
alpestris, *Hall. f.*
argentea, *L.*
— var. calabra, (*Tenore*).
arguta, *Pursh.*
argyrophylla, *Wall.*
chinensis, *Ser.*
Comarum, *Nestl.*
collina, *Wibel.*
Detommasii, *Tenore.*
digitata × flabellata.
glandulosa, *Lindl.*
gracilis, *Dougl.*
heptaphylla, *Mill.*
hippiana, *Lehm.*
hirta, *L.*
kotschyana, *Fenzl.*
kurdica, *Boiss.*
montenegrina, *Pantoc.*
mooniana, *Wight.*
multifida, *L.*
nevadensis, *Boiss.*
opaca, *L.*
pennsylvanica, *L.* var. arachnoidea, *Lehm.*
pyrenaica, *Ramond.*

Potentilla, *cont.*
recta, *L.*
— var. laciniata.
— var. macrantha.
— var. palmata.
rivalis, *Nutt.* var. millegrana, *Wats.*
rupestris, *L.*
schrenkiana, *Regel.*
semi-laciniata, *Hort.*
sericea, *L.*
Sibbaldia, *Hall. f.*
tanacetifolia, *Willd.*
tridentata, *Soland.*
Visianii, *Panc.*
wrangeliana, *Fisch. & Mey.*

Poterium alpinum, *Hort.Kew.*
canadense, *A. Gray.*
officinale, *A. Gray.*
Sanguisorba, *L.*

Pratia angulata, *Hook. f.*

Prenanthes purpurea, *L.*

Primula algida, *Adams.*
capitata, *Hook.*
cortusoides, *L.*
denticulata, *Sm.*
elatior, *Hill.*
Forbesi, *Franch.*
japonica, *A. Gray.*
obconica, *Hance.*
officinalis, *Jacq.*
Poissoni, *Franch*
rosea, *Royle.*
verticillata, *Forsk.*
vulgaris, *Huds.*

Prunella grandiflora, *Jacq.*
— var. laciniata, *Hort.*
— var. rubra, *Hort.*
vulgaris, *L.*

Psoralea macrostachya, *DC.*
physodes, *Hook.*

Pulicaria dysenterica, *Gaertn.*

Ramondia pyrenaica, *Rich.*

Ranunculus acris, *L.*
— var. Steveni.
arvensis, *L.*
Broteri, *Freyn.*
brutius, *Tenore.*
caucasicus, *Bieb.*

Ranunculus, *cont.*
chaerophyllus, *L.*
Chius, *DC.*
Cymbalaria, *Pursh.*
falcatus, *L.*
Flammula, *L.*
gramineus, *L.*
lanuginosus, *L.*
Lingua, *L.*
muricatus, *L.*
ophioglossifolius, *Vill.*
Sardous, *Cr.*
trilobus, *Desf.*

Raphanus maritimus, *Sm.*
sativus, *L.*

Rapistrum linnaeanum, *Boiss. & Reut.*

Reseda alba, *L.*
glauca, *L.*
lutea, *L.*
Luteola, *L.*
odorata, *L.*
virgata, *Boiss. & Reut.*

Rhagadiolus Hedypnois, *Fisch. & Mey.*
stellatus, *Gaertn.*

Rheum collinianum, *Baill.*
Emodi, *Wall.*
Franzenbachii, *Muent.*
macropterum, *Mart.*
officinale, *Baill.*
palmatum, *L.*
— var. tanghuticum.
Rhaponticum, *L.*
undulatum, *L.*
webbianum, *Royle.*

Ricinus communis, *L.*

Roemeria hybrida, *DC.*

Rubia peregrina, *L.*

Rudbeckia amplexicaulis, *Vahl.*
digitata, *Mill.*
hirta, *L.*
laciniata; L.
maxima, *Nutt.*
speciosa, *Wender.*

Rumex abyssinicus, *Jacq.*
alpinus, *L.*
Acetosella, *L.*

Rumex, *cont.*
Brownii, *Campd.*
conglomeratus, *Murr.*
crispus, *L.*
nepalensis, *Spreng.*
obtusifolius, *L.*
— var. sylvestris, (*Wallr.*).
occidentalis, *S. Wats.*
orientalis, *Bernh.*
Patientia, *L.*
pulcher, *L.*
roseus, *L.*
salicifolius, *Weinm.*
sanguineus, *L.*
scutatus, *L.*
vesicarius, *L.*

Ruta graveolens, *L.*

Sagina glabra, *Fenzl.*
— var. pilifera, (*Fenzl*).

Salpiglossis linearis, *Hook.* var. grandiflora.
sinuata, *Ruiz & Pav.*

Salvia argentea, *L.*
Beckeri, *Trautv.*
cadmica, *Boiss.*
clandestina, *L.*
Columbariae, *Benth.*
glutinosa, *L.*
hians, *Royle.*
Horminum, *L.*
— var. bracteis roseis.
— var. bracteis violaceis.
interrupta, *Schousb.*
lanceolata, *Brouss.*
lyrata, *L.*
nubicola, *Wall.*
nutans, *L.*
officinalis, *L.*
pratensis, *L.*
—var. Baumgarteni, (*Heuff.*).
—var. rosea.
regeliana, *Trautv.*
schiedeana, *Stapf.*
Sclarea, *L.*
sylvestris, *L.*
tiliaefolia, *Vahl.*
Verbenaca, *L.*
— var. disermas, (*Sibth. & Sm.*).
verticillata, *L.*
virgata, *Ait.*
viscosa, *Jacq.*

Samolus Valerandi, *L.*
— var. americanus, *A. Gray.*

Sanvitalia procumbens, *Lam.*

Saponaria calabrica, *Guss.*
orientalis, *L.*
Vaccaria, *L.*

Saracha Jaltomata, *Schlecht.*

Satureja montana, *L.*

Saussurea albescens, *Hook. f. & Thoms.*

Saxifragra Aizoon, *L.*
— var. Churchillii, *Kern.*
— var. Gaudinii, (*Bruegg.*).
— var. incrustata.
— var. pectinata, (*Schott*).
— var. rosularis, *Schleich.*
— var. rotata.
caespitosa, *L.*
— var. hirta.
cartilaginea, *Willd.*
cochlearis, *Reichb.*
Cotyledon, *L.*
— var. pyramidalis, (*Lapeyr.*).
crustata, *Vest.*
decipiens, *Ehrh.* var. Steinmanni, (*Tausch*).
Geum, *L.*
glaucescens, *Reut.*
granulata, *L.*
hirsuta, *L.*
Hostii, *Tausch.*
— var. altissima, (*Kern.*).
— var. macnabiana, *Hort.*
hypnoides, *L.*
lingulata, *Bell.*
— var. lantoscana, (*Boiss. & Reut.*).
longifolia, *Lapeyr.*
muscoides, *Wulf.*
— var. pygmaea, (*Haw.*).
mutata, *L.*
peltata, *Torr. & Gray.*
rocheliana, *Sternb.* var. coriophylla, (*Griseb.*).
rotundifolia, *L.*
— var. hirsuta.
sarmentosa, *L.*
Sibthorpii, *Boiss.*
umbrosa, *L.*
— var. gracilis.
valdensis, *DC.*

Scabiosa amoena, *Jacq.*
arvensis, *L.*
atropurpurea, *L.*
australis, *Wulf.*
brachiata, *Sibth. & Sm.*
caucasica, *Bieb.*
Columbaria, *L.*
graminifolia, *L.*
gramuntia, *L.*
integrifolia, *L.*
isetensis, *L.*
lancifolia, *Lernat.*
macedonica, *Vis.*
micrantha, *Desf.*
palaestina, *L.*
Portae, *Huter.*
prolifera, *L.*
Pterocephala, *L.*
succisa, *L.*
sylvatica, *L.*
vestina, *Facc.*

Scandix Balansae, *Reut.*

Schizanthus pinnatus, *Ruiz & Pav.*
retusus, *Hook.*

Schizopetalum Walkeri, *Sims.*

Scilla bifolia, *L.*
festalis, *Salisb.*
hispanica, *Mill.*
peruviana, *L.*
sibirica, *Andrews.*
verna, *Huds.*

Scirpus Eriophorum, *Michx.*
Holoschoenus, *L.*
polyphyllus, *Vahl.*
setaceus, *L.*
triqueter, *L.*

Scleranthus annuus, *L.*

Sclerocarpus uniserialis, *Benth. & Hook. f.*

Scolymus maculatus, *L.*

Scopolia lurida, *Dun.*

Scorpiurus vermiculata, *L.*

Scorzonera hirsuta, *L.*
hispanica, *L.*
laciniata, *L.*

Scrophularia alata, *Gilib.*
alpestris, *J. Gay.*
aquatica, *L.*
nodosa, *L.*
Scorodonia, *L.*
sylvatica, *Boiss. & Heldr.*
vernalis, *L.*

Scutellaria albida, *L.*
alpina, *L.*
altissima, *L.*
baicalensis, *Georgi.*
galericulata, *L.*

Secale Cereale, *L.*

Securigera Coronilla, *L.*

Sedum acre, *L.*
Aizoon, *L.*
album, *L.*
amplexicaule, *DC.*
Anacampseros, *L.*
caeruleum, *Vahl.*
Ewersii, *Ledeb.*
hispanicum, *L.*
hybridum, *L.*
maximum, *Sut.*
— var. atropurpureum.
middendorfianum, *Maxim.*
roseum, *Scop.*
rupestre, *L.*
Telephium, *L.*
villosum, *L.*
wallichianum, *Hook. f. & Thoms.*

Selinum Gmelini, *Bray.*
tenuifolium, *Wall.*

Sempervivum arvernense, *Lecoq & Lamotte.*
Boissieri, *Hort.*
boutignyanum, *Billot & Gren.*
caucasicum, *Rupr.*
flagelliforme, *Fisch.*
mettenianum, *Schnittsp.*
montanum, *L.*
obscurum, *Hort.*
Pilosella, *Hort.*
Pomellii, *Lamotte.*
speciosum, *Lamotte.*
tectorum, *L.*
— var. rusticanum, *Hort.*
Verloti, *Lamotte.*
violaceum, *Hort.*

Senecio adonidifolius, *Loisel.*
aegyptius, *L.*
aurantiacus, *DC.*
Cineraria, *DC.*
diversifolius, *Wall.*
Doria, *L.*
Doronicum, *L.*
elegans, *L.*
Hodgsoni, *Hort. Kew.*
japonicus, *Sch. Bip.*
Kaempferi, *DC.*
macrophyllus, *Bieb.*
nemorensis, *L.*
sarracenicus, *L.*
squalidus, *L.*
suaveolens, *Ell.*
thyrsoideus, *DC.*
viscosus, *L.*

Serratula coronata, L.
heterophylla, *Desf.*
quinquefolia, *Bieb.*
tinctoria, *L.*

Sesamum indicum, *L.*

Seseli elatum, *L.*
gummiferum, *Sm.*
osseum, *Crantz.*

Sesleria cylindrica, *DC.*

Setaria glauca, *Beauv.*
italica, *Beauv.*
macrochaeta, *Spreng.*
verticillata, *Beauv.*
viridis, *Beauv.*

Sherardia arvensis, *L.*

Sidalcea candida, *A. Gray.*

Sideritis scordioides, *L.*

Siegesbeckia orientalis, *L.*

Silene alpestris, *Jacq.*
Armeria, *L.*
chloraefolia, *Sm.* var. swertifolia.
chromodonta, *Boiss. & Reut.*
ciliata, *Pourr.*
clandestina, *Jacq.*
colorata, *Poir.*
conoidea, *L.*
cretica, *L.*
Cucubalus, *Wibel.*
echinata, *Otth.*

Silene, *cont.*
Fabaria, *Sibth. & Sm.*
fimbriata, *Sims.*
Fortunei, *Vis.*
fuscata, *Link.*
gallica, *L.*
glauca, *Pourr.*
italica, *Pers.*
juvenalis, *Delile.*
laeta, *A. Br.*
linicola, *C. C. Gmel.*
longicilia, *Otth.*
longiflora, *Ehrh.*
monachorum, *Vis.*
Muscipula, *L.*
noctiflora, *L.*
nutans, *L.*
obtusifolia, *Willd.*
pendula, *L.*
quadrifida, *L.*
rubella, *L.*
Sartori, *Boiss.*
Saxifraga, *L.*
Schafta, *Gmel.*
sedoides, *Jacq.*
squamigera, *Boiss.*
stylosa, *Bunge.*
tatarica, *Pers.*
tenuis, *Willd.*
undulata, *Ait.*
verecunda, S. *Wats.*
vesiculifera, *J. Gay.*

Siler trilobum, *Scop.*

Silphium integrifolium, *Michx.*
perfoliatum, *L.*
scaberrimum, *Ell.*
trifoliatum, *L.*
— var. ternatum, *Retz.*

Silybum eburneum, *Coss. & Dur.*
Marianum, *Gaertn.*

Sisymbrium assoanum, *Losc. & Pard.*
austriacum, *Jacq.*
erysimoides, *Desf.*
hispanicum, *Jacq.*
multifidum, *Willd.*
polyceratium, *L.*
Sophia, *L.*
strictissimum, *L.*
tanacetifolium, *L*
Thaliana, *Hook.*

Sisyrinchium angustifolium, *Mill.*
striatum, *Sm.*

Sium latifolium, *L.*

Smilacina racemosa, *Desf.*
stellata, *Desf.*

Smyrnium Olusatrum, *L.*

Solanum guineense, *Lam.*
nigrum, *L.*
villosum, *Willd.*

Solenanthes lanatus, *A.DC.*

Solidago arguta, *Ait.*
canadensis, *L.*
Drummondi, *Torr. & Gray.*
elliptica, *Ait.*
elongata, *Nutt.*
glomerata, *Michx.*
lithospermifolia, *Willd.*
Virgaurea, *L.*

Sonchus oleraceus, *L.*
palustris, *L.*

Sophora angustifolia, *Sieb. & Zucc.*

Sorghum vulgare, *Pers.*

Sparganium simplex, *Huds.*

Spartina Schreberi, *J. F. Gmel.*

Specularia falcata, *A.DC.*
— var. castellana, *Lange.*
pentagonia, *A.DC.*
perfoliata, *A.DC.*
Speculum, *A.DC.*

Spergula arvensis, *L.*

Spiraea Aruncus, *L.*
Filipendula, *L.*
Ulmaria, *L.*

Sporobolus airoides, *Torr.*
asper, *Kunth.*
cryptandrus, *A. Gray.*
heterolepis, *A. Gray.*
Wrighti, *Munro.*

Stachys alpina, *L.*
— var. intermedia.
annua, *L.*
arvensis, *L.*
Betonica, *Benth.*

Stachys, *cont.*
germanica, *L.*
grandiflora, *Benth.*
setifera, *C. A. Mey.*
sylvatica, *L.*

Statice bellidifolia, *Gouan.*
cordata, *L.*
echioides, *L.*
eximia, *Schrenk.*
Gmelinii, *Willd.*
gougetiana, *Girard.*
Limonium, *L.*
sinuata, *L.*
speciosa, *L.*
subpuberula, *Hort.*
tatarica, *L.*
Thouini, *Viv.*
tomentella, *Boiss.*

Stevia Eupatoria, *Willd.*

Stipa Aristella, *L.*
Calamagrostis, *Wahlenb.*
capillata, *L.*
papposa, *Nees.*
pennata, *L.*
sibirica, *Lam.*
spartea, *Trin.*
viridula, *Trin.*

Suaeda maritima, *Dum.*

Succowia balearica, *Medic.*

Swertia cordata, *Wall.*
perennis, *L.*

Symphyandra Hofmanni, *Pant.*
pendula, *A.DC.*
Wanneri, *Heuff.*

Symphytum peregrinum, *Ledeb.*

Synthyris reniformis, *Benth.*

Syrenia sessiliflora, *Ledeb.*

Tagetes erecta, *L.*
patula, *L.*
pusilla, *H. B. & K.*

Tamus communis, *L.*

Tanacetum vulgare, *L.*

Taraxacum gymnanthum, *DC.*

Telephium Imperati, *L.*

Tellima grandiflora, *R.Br.*

Tetragonia crystallina, *L'Herit.*
expansa, *Murr.*

Teucrium Arduini, *L.*
aureum, *Schreb.*
Botrys, L.
canadense, *L.*
Chamaedrys, *L.*
Marum, *L.*
montanum, *L.*
multiflorum, *L.*
Scorodonia, *L.*
— var. crispum.

Thalictrum angustifolium, *L.*
aquilegifolium, *L.*
flavum, *L.*
— var. sphaerocarpum, (*Lej. & Court.*).
glaucum, *Desf.*
minus, *L.*
—var. affine, (*Jord.*).
—var. concinnum, (*Willd.*).
—var. elatum, (*Jacq.*).
—var. flexuosum, (*Bernh.*).
—var. pubescens, (*Schleich.*).
— var. purpurascens, (*Georgi*).
squarrosum, *Stephan.*

Thaspium trifoliatum, *A. Gray.*

Thelesperma filifolium, *A. Gray*

Thermopsis caroliniana, *M. A. Curtis.*
montana, *Nutt.*

Thladiantha dubia, *Bunge.*

Thlaspi arvense, *L.*
ceratocarpon, *Murr.*
kotschyanum, *Boiss.*
latifolium, *Bieb.*
perfoliatum, *L.*

Thymus comosus, *Heuff.*

Tigridia Pavonia, *Ker-Gawl.*

Tinantia fugax, *Scheidw.*

Tofieldia calyculata, *Wahlenb.*

Tolmiea Menziesii, *Torr. & Gray.*

Tolpis barbata, *Gaertn.*

Trachelium caeruleum, *L.*

Trachymene pilosa, *Sm.*

Tragopogon pratensis, *L.*

Tricholepis furcata, *DC.*

Tridax trilobata, *Hemsl.*

Trifolium agrarium, *L.*
angustifolium, *L.*
armenium, *Willd.*
Balansae, *Boiss.*
clypeatum, *L.*
diffusum, *Ehrh.*
fragiferum, *L.*
glomeratum, *L.*
hybridum, *L.*
incarnatum, *L.*
lappaceum, *L.*
leucanthum, *Bieb.*
maritimum, *Huds.*
medium, *L.*
multistriatum, *Koch.*
pannonicum, *L.*
Perreymondi, *Gren. & Godr.*
pratense, *L.*
procumbens, *L.*
purpureum, *Loisel.*
repens, *L.*
resupinatum, *L.*
rubens, *L.*
scabrum, *L.*
spumosum, *L.*
squarrosum, *L.*
striatum, *L.*
tomentosum, *L.*
tridentatum, *Lindl.*

Triglochin maritimum, *L.*
palustre, *L.*

Trigonella Balansae, *Boiss. & Reut.*
corniculata, *L.*
caerulea, *Ser.*
cretica, *Boiss.*
Foenum-graecum, *L.*
ovalis, *Boiss.*
polycerata, *L.*
radiata, *Boiss.*

Trillium grandiflorum, *Salisb.*

Tripteris cheiranthifolia, *Schultz.*

Trisetum flavescens, *Beauv.*
rigidum, *Roem. & Schult.*

Triticum durum, *Desf.*
monococcum, *L.*
ovatum, *Rasp.*
villosum, *Beauv.*
violaceum, *Hornem.*
vulgare, *Vill.*

Tritonia Pottsii, *Benth.*

Trollius asiaticus, *L.*

Tropaeolum aduncum, *Sm.*
majus, *L.*
minus, *L.*

Troximon grandiflorum, *A. Gray.*
laciniatum, *A. Gray.*

Tunica olympica, *Boiss.*
prolifera, *Scop.*
Saxifraga, *Scop.*

Typha angustifolia, *L.*
latifolia, *L.*
stenophylla, *Fisch. & Mey.*

Tyrimnus leucographus, *Cass.*

Uniola latifolia, *Michx.*

Urospermum picroides, *Desf.*

Ursinia pulchra, *N. E. Br.*

Urtica membranacea, *Poir.*
pilulifera, *L.*
— var. balearica, (*L.*).
thunbergiana, *Sieb. & Zucc.*

Valeriana officinalis, *L.*
— var. exaltata, (*Mikan*).
— var. sambucifolia, (*Mikan*).
Phu, *L.*

Valerianella carinata, *Loisel.*
coronata, *DC.*
dentata, *Poll.*
echinata, *DC.*
eriocarpa, *Desv.*
olitoria, *Poll.*
vesicaria, *Moench.*

Veratrum album, *L.*
nigrum, *L.*
viride, *Ait.*

Verbascum Blattaria, *L.*
Chaixii, *Vill.*

Verbascum, *cont.*
Lychnites, *L.*
malacotrichum, *Boiss. & Heldr.*
nigrum, *L.*
orientale, *Bieb.*
phlomoides, *L.*
phœniceum, *L.*
pulverulentum, *Vill.*
pyramidatum, *Bieb.*
sinuatum, *L.*
speciosum, *Schrad.*
Thapsus, *L.*
virgatum, *With.*

Verbena angustifolia, *Michx.*
Aubletia, *L.*
biserrata, *H. B.*
bonariensis, *L.*
caroliniana, *Michx.*
officinalis, *L.*

Verbesina helianthoides, *Michx*

Vernonia altissima, *Nutt.*

Veronica aphylla, *L.*
— var. pinnatifida.
Bidwillii, *Hook. f.*
Buxbaumii, *Tenore.*
exaltata, *Maud.*
incana, *L.*
incisa, *Ait.*
longifolia, *L.*
— var. subsessilis, *Miq.*
officinalis, *L.*
repens, *DC.*
saxatilis, *Scop.*
serpyllifolia, *L.*
spicata, *L.*
virginica, *L.*
— var. japonica, (*Steud.*).

Vicia amphicarpa, *Dorth.*
argentea, *Lapeyr.*
bithynica, *L.*
calcarata, *Desf.*
Cracca, *L.*
disperma, *DC.*
Faba, *L.*
— var. equina, (*Steud.*).
gigantea, *Hook.*
narbonensis, *L.*
pratensis, *Mert.*
pyrenaica, *Pourr.*
sativa, *L.*
sepium, *L.*

Vicia, *cont.*
sicula, *Guss.*
sylvatica, *L.*
unijuga, *A. Braun.*
varia, *Host.*
villosa, *Roth.*

Vincetoxicum fuscatum, *Reichb. f.*
nigrum, *Moench.*
officinale, *Moench.*

Viola cornuta, *L.*
elatior, *Fries.*
hirta, *L.*
Jooi, *Janka.*
lutea, *Huds.*
odorata, *L.*
palustris, *L.*
pubescens, *Ait.*
striata, *Ait.*
sylvestris, *Lam.*
syrtica, *Sünd.*
tricolor, *L.*

Wahlenbergia capensis, *A.DC.*
dalmatica, *A.DC.*
tenuifolia, *A.DC.*
undulata, *A.DC.*

Xanthium spinosum, *L.*
strumarium, *L.*

Xanthocephalum gymnospermoides, *Benth. & Hk. f.*

Xeranthemum annuum, *L.*
cylindraceum, *Sibth. & Sm.*

Zaluzianskya capensis, *Walp.*

Zea Mays, *L.*

Zinnia haageana, *Regel.*
pauciflora, *L.*

Ziziphora tenuior, *L.*

Zygadenus elegans, *Pursh.*

TREES AND SHRUBS.

Acanthopanax sessiliflorum, *Seem.*

Acer campestre, *L.*
— var. aetnense.
— var. collinum, *Wallr.*
circinatum, *Pursh.*
coriaceum, *Tausch.*
hyrcanum, *Fisch. & Mey.*
insigne, *Boiss. & Buhse.*
Lobelii, *Tenore.*
macrophyllum, *Pursh.*
monspessulanum, *L.*
opulifolium, *Vill.*
— var. neapolitanum.
Pseudo-Platanus, *L.*
— var. lutescens.
— var. purpureum.
tataricum, *L.*

Ailantus glandulosa, *Desf.*

Alnus cordifolia, *Tenore.*
glutinosa, *Gaertn.*
incana, *Willd.*
japonica, *Sieb. & Zucc.*
maritima, *Muehlenb.*

Alnus, *cont.*
nitida, *Endl.*
oregona, *Nutt.*
orientalis, *Decne.*
serrulata, *Willd.*
subcordata, *C. A. Mey.*
viridis, *DC.*

Amelanchier canadensis, *Torr. & Gray.*
— var. oblongifolia, *Torr. & Gray.*
vulgaris, *Moench.*

Amorpha canescens, *Nutt.*
fruticosa, *L.*

Andromeda polifolia, *L.*

Arbutus Andrachne, *L.*
Menziesii *Pursh.*
Unedo, *L.*

Aucuba japonica, *Thunb.*

Baccharis halimifolia, *L.*

Berberis angulosa, *Wall.*
Aquifolium, *Pursh.*
— var. fascicularis, *Nichols.*
— var. murrayana, *Hort.*
aristata, *DC.*
— var. floribunda.
— var. umbellata.
buxifolia, *Lam.*
canadensis, *Pursh.*
concinna, *Hook. f.*
Darwinii, *Hook.*
repens, *Lindl.*
Sieboldii, *Miq.*
sinensis, *Desf.*
— var. spathulata.
Thunbergi, *DC.*
virescens, *Hook. f.*
vulgaris, *L.*
— var. foliis purpureis.
— var. iberica, *Hort.*
wallichiana, *DC.*

Betula alba, *L.*
— var. pubescens, *Loud.*
corylifolia, *Regel & Maxim.*
davurica, *Pall.*
Ermani, *Cham.*
fruticosa, *Pall.*
— var. Gmelini, *Regel.*
humilis, *Schrenk.*
lenta, *L.*
lutea, *Michx.*
papyrifera, *Marsh.*
populifolia, *Marsh.*
ulmifolia, *Sieb. & Zucc.*

Bruckenthalia spiculifolia, *Reichb.*

Buddleia intermedia, *Carr.*
japonica, *Hemsl.*
variabilis, *Hemsl.*

Bumelia lanuginosa, *Pers.*

Buxus sempervirens, *L.*
— var. latifolia.
— var. prostrata.

Calluna vulgaris, *Salisb.*

Calophaca wolgarica, *Fisch.*

Calycanthus occidentalis, *Hook. & Arn.*

Caragana arborescens, *Lam.*
— var. Redowskii.

Caragana, *cont.*
aurantiaca, *Koehne.*
brevispina, *Royle.*
frutescens, *DC.*
microphylla, *Lam.*
pygmaea, *DC.*

Carmichaelia australis, *R. Br.*

Carpinus Betulus, *L.*
— var. incisa.
caroliniana, *Walt.*
orientalis, *Mill.*

Cassandra calyculata, *D. Don.*

Cassinia fulvida, *Hook. f.*
leptophylla, *Hort.*

Catalpa cordifolia, *Jaume.*

Ceanothus americanus, *L.*
Arnoldi, *Hort.*
azureus, *Desf.*
grandiflorus, *Hort.*
papillosus, *Torr. & Gray.*

Celastrus articulatus, *Thunb.*

Celtis occidentalis, *L.*

Cistus hirsutus, *Lam.*
laurifolius, *L.*
salvifolius, *L.*
vaginatus, *Ait.*

Cladrastis amurensis, *Benth.*

Clematis aethusifolia, *Turcz.*
alpina, *Mill.*
campaniflora, *Brot.*
crispa, *L.*
Flammula, *L.*
Fremontii, *S. Wats.*
fusca, *Turcz.*
lanuginosa, *Lindl.*
montana, *Wall.*
orientalis, *L.*
Pitcheri, *Torr. & Gray.* var. lasiostylis.
songorica, *Bunge.*
Vitalba, *L.*
Viticella, *L.* var. alba.
— var. rubra.

Clethra acuminata, *Michx.*
alnifolia, *L.*
— var. Michauxii.

Colutea arborescens, *L.*
cruenta, *Ait.*
melanocalyx, *Boiss.*

Conyza ivaefolia, *Less.*

Coriaria japonica, *A. Gray.*

Cornus alba, *L.*
alternifolia, *L. f.*
Amomum, *Mill.*
Baileyi, *Coult. & Evans.*
glabrata, *Benth.*
Mas, *L.*
pubescens, *Nutt.*
sanguinea, *L.*
stolonifera, *Michx.*

Coronilla Emerus, *L.*

Corylus rostrata, *Ait.*

Cotoneaster affinis, *Lindl.*
bacillaris, *Wall.*
— var. floribunda, *Hort.*
buxifolia, *Wall.*
frigida, *Wall.*
horizontalis, *Decne.*
integerrima, *Medic.*
laxiflora, *Jacq.*
lucida, *Schlecht.*
microphylla, *Wall.*
multiflora, *Bunge.*
Nummularia, *Fisch. & Mey.*
pannosa, *Franch.*
rotundifolia, *Wall.*
Simonsii, *Baker.*
thymifolia, *Baker.*

Crataegus Carrièrei, *Vauvel.*
chlorosarca, *Maxim.*
coccinea, *L.*
—var. macracantha, *Dudley.*
cordata, *Ait.*
Crus-Galli, *L.*
Douglasii, *Lindl.*
— var. rivularis, *Nutt.*
flava, *Ait.*
heterophylla, *Fluegg.*
hiemalis, *Lange.*
melanocarpa, *Bieb.*
mollis, *Scheele.*
monogyna, *Jacq.*
— var. sibirica, *Loud.*
nigra, *Waldst. & Kit.*
orientalis, *Pall.*
— var. sanguinea.

Crataegus, *cont.*
oxyacanthoides, *Thuill.*
— var. fructu luteo.
pentagyna, *Kit.*
pinnatifida, *Bunge.*
punctata, *Jacq.*
Pyracantha, *Pers.*
sinaica, *Boiss.*
tanacetifolia, *Pers.*
tomentosa, *L.*
uniflora, *Muench.*

Cryptomeria japonica, *D. Don.*

Cupressus Benthami, *Endl.*
lawsoniana, *Murr.*
nootkatensis, *Lamb.*
obtusa, *C. Koch.*
pisifera, *C. Koch.*
thyoides, *L.*
torulosa, *D. Don.*
— var. corneyana.

Cytisus albus, *L.*
biflorus, *L'Herit.*
capitatus, *Jacq.*
nigricans, *L.*
praecox, *Hort.*
purgans, *Boiss.*
purpureus, *Scop.*
scoparius, *L.*
— var. andréanus.
— var. pendulus.
— var. sulphureus.
sessilifolius, *L.*

Daboëcia polifolia, *D. Don.*

Desmodium viridiflorum, *Beck.*

Deutzia corymbosa, *R. Br.*
crenata, *Sieb. & Zucc.*
scabra, *Thunb.*

Diervilla hortensis, *S. & Z.*
sessilifolia, *Buckl.*
— var. splendens.

Dorycnium suffruticosum, *Vill.*

Eccremocarpus scaber, *Ruiz & Pav.*

Elaeagnus angustifolia, *L.*
argentea, *Pursh.*
multiflora, *Thunb.*
umbellata, *Thunb.*

Erica ciliaris, *L.*
cinerea, *L.*
mediterranea, *L.*
multiflora, *L.*
scoparia, *L.*
stricta, *Donn.*
Tetralix, *L.*
vagans, *L.*
Watsoni, *DC.*

Escallonia exoniensis, *Hort.*
punctata, *DC.*
rubra, *Pers.*

Euonymus atropurpureus, *Jacq.*
europaeus, *L.*
— var. purpureus.
latifolius, *Scop.*
nanus, *Bieb.*
obovatus, *Nutt.*

Exochorda Alberti, *Regel.*

Fraxinus floribunda, *Wall.*
nigra, *Marsh.*
Ornus, *L.*
rhynchophylla, *Hance.*

Garrya flavescens, *S. Wats.*

Gaultheria procumbens, *L.*
pyrolaefolia, *Hook. f.*
Shallon, *Pursh.*

Gaylussacia resinosa, *Torr. & Gray.*

Genista aethnensis, *DC.*
anglica, *L.*
cinerea, *DC.*
germanica, *L.*
hispanica, *L.*
pilosa, *L.*
sagittalis, *L.*
tinctoria, *L.* var. elatior.
virgata, *DC.*

Halesia corymbosa, *Nichols.*
tetraptera, *L.*

Hedera Helix, *L.*

Hedysarum multijuga, *Maxim.*

Helianthemum formosum, *Dunal.*
halimifolium, *Willk.*
polifolium, *Pers.*
vulgare, *Gaertn.*

Helianthemum, *cont.*
— var. mutabile.
— var. rhodanthum.

Hippophaë rhamnoides, *L.*

Hovenia dulcis, *Thunb.*

Hydrangea arborescens, *L.*
Hortensia, *DC.* var. acuminata, *A. Gray.*
paniculata, *Sieb. & Zucc.*
pubescens, *Decne.*
radiata, *Walt.*

Hymenanthera crassifolia, *Hook. f.*

Hypericum Androsaemum, *L.*
Ascyron, *L.*
aureum, *Bartr.*
calycinum, *L.*
elatum, *Ait.*
hircinum, *L.*
hookerianum, *Wight & Arn.*
inodorum, *Jacq.*
kalmianum, *L.*
moserianum, *André.*
patulum, *Thunb.*
prolificum, *L.*
uralum, *Don.*

Ilex Aquifolium, *L.*
decidua, *Walt.*
glabra, *A. Gray.*
laevigata, *A. Gray.*
opaca, *Ait.*
verticillata, *A. Gray.*
— var. fructu luteo.

Jasminum fruticans, *L.*
humile, *L.*

Juniperus chinensis, *L.*
communis, *L.*
excelsa, *Bieb.*
Sabina, *L.*
sphaerica, *Lindl.*

Kalmia angustifolia, *L.*
— var. nana.
— var. ovata.
glauca, *Ait.*
latifolia, *L.*

Laburnum alpinum, *J. S. Presl.*
—var. biferum, *Hort.*
—vulgare, *J. S. Presl*

Larix davurica, *Trautv.*
europaea, *DC.*
leptolepis, *Endl.*
— var. murrayana.
occidentalis, *Nutt.*

Ledum latifolium, *Ait.*
palustre, *L.*

Lespedeza Stuvei, *Nutt.*

Leucothoe Catesbaei, *A. Gray.*
Davisiae, *Torr.*
racemosa, *A. Gray.*

Leycesteria formosa, *Wall.*

Ligustrum Ibota, *Sieb.*
—var. regelianum.
japonicum, *Thunb.*
sinense, *Lour.*
vulgare, *L.*

Lindera Benzoin, *Blume.*

Liriodendron tulipifera, *L.*

Lonicera alpigena, *L.*
angustifolia, *Wall.*
Caprifolium, *L.*
flava, *Sims.*
glauca, *Hill.*
japonica, *Thunb.*
Morrowii, *A. Gray.*
nigra, *L.*
orientalis, *Lam.*
Periclymenum, *L.*
— var. serotina.
Sullivantii, *A. Gray.*
tatarica, *L.*
Xylosteum, *L.*

Lupinus arboreus, *L.*

Lyonia paniculata, *Nutt.*

Magnolia tripetala, *L.*

Menispermum canadense, *L.*

Menziesia globularis, *Salisb.*

Microglossa albescens, *C. B. Clarke.*

Morus nigra, *L.*

Myrica cerifera, *L.*
Gale, *L.*

Myricaria germanica, *Desv.*

Neillia amurensis, *Benth. & Hook.*
opulifolia, *Benth. & Hook.*
Torreyi, *Wats.*

Olearia Haastii, *Hook. f.*
macrodonta, *Baker.*

Ononis aragonensis, *Asso.*
fruticosa, *L.*
rotundifolia, *L.*

Ostrya carpinifolia, *Scop.*

Oxydendron arboreum, *DC.*

Pernettya mucronata, *Gaudich.*

Petteria ramentacea, *Presl.*

Philadelphus acuminatus, *Lange.*
coronarius, *L.*
— var. tomentosus, *Hook. f. & Thoms.*
gordonianus, *Lindl.*
grandiflorus, *Willd.*
hirsutus, *Nutt.*
Keteleeri, *Hort.*
Lemoinei, *Hort.*
Lewisii, *Pursh.*
Satsumi, *Siebold.*

Photinia variabilis, *Hemsl.*

Picea Glehni, *F. Schmidt.*

Pieris japonica, *D. Don.*
mariana, *Benth. & Hook.*

Pinus Cembra, *L.*
Jeffreyi, *A. Murr.*
monticola, *Dougl.*
Peuke, *Griseb.*
ponderosa, *Dougl.*
Thunbergii, *Parl.*
tuberculata, *Gord.*

Piptanthus nepalensis, *Sweet.*

Platanus acerifolia, *Willd.*
occidentalis, *L.*

Populus deltoidea, *Marsh.*
nigra, *L.*

Potentilla fruticosa, *L.*
salesoviana, *Steph.*

Prunus acida, *Borkh.* var. semperflorens.
alleghaniensis, *Porter.*
americana, *Marsh.*
Amygdalus, *Stokes.*
Avium, *L.*
Brigantiaca, *Chaix.*
Capollin, *Zucc.*
cerasifera, *Ehrh.*
demissa, *Walp.*
humilis, *Bunge.*
Laurocerasus, *L.* var. colchica.
lusitanica, *L. f.*
maritima, *Wangenh.*
Persica, *Stokes.* var. foliis rubris.
serotina, *Ehrh.*

Ptelea trifoliata, *L.*
— var. glauca.

Pyrus americana, *DC.*
arbutifolia, *L.*
Aria, *L.*
— var. graeca, *Boiss.*
Aucuparia, *Gaertn.*
baccata, *L.*
Balansae, *Decne.*
betulaefolia, *Bunge.*
canescens, *Spach.*
communis, *L.*
Cydonia, *L.*
decaisneana, *Nichols.*
floribunda, *Nichols.*
germanica, *Hook. f.*
intermedia, *Ehrh.*
japonica, *Thunb.*
lanata, *D. Don.*
lobata, *Nichols.*
longipes, *Coss. & Durieu.*
Malus, *L.*
Maulei, *Mast.*
Michauxi, *Bosc.*
nigra, *Sargent.*
nivalis, *Jacq.*
pinnatifida, *Ehrh.*
prunifolia, *Willd.*
Ringo, *Maxim.*
sikkimensis, *Hook. f.*
sinaica *Thouin.*
Sorbus *Gaertn.*
spectabilis, *Ait.*
spuria, *DC.*
Toringo, *Sieb.*

Rhamnus Alaternus, *L.*
— var. angustifolius.
carolinianus, *Walt.*
catharticus, *L.*
crenata, *Sieb. & Zucc.*
Frangula, *L.*
libanoticus, *Boiss.*
purshianus, *DC.*

Rhododendron campanulatum, *D. Don.*
cinnabarinum, *Hook. f.*
ferrugineum, *L.*
flavum, *G. Don.*
myrtifolium, *Lodd.*
ponticum, *L.*
— var. cheiranthifolium.
— — lancifolium.
Smirnowi, *Trautv.*

Rhodotypus kerrioides, *Sieb. & Zucc.*

Rhus Cotinus, *L.*
glabra, *L.*
Toxicodendron, *L.*
typhina, *L.*

Ribes alpinum, *L.*
— var. pumilum, *Hort.*
aureum, *Pursh.*
— var. aurantiacum minus, *Hort.*
— var. praecox, *Lindl.*
— var. tenuiflorum, *Torr.*
cereum, *Dougl.*
divaricatum, *Dougl.*
Grossularia, *L.*
multiflorum, *Waldst. & Kit.*
petraeum, *Wulf.*
robustum, *Hort.*
rubrum, *L.*
— var. Schlechtendalii.
sanguineum, *Pursh.*
— var. atrosanguineum, *Hort.*
— var. epruinosum, *K. Koch.*

Robinia Pseudacacia, *L.*

Rosa acicularis, *Lindl.*
agrestis, *Savi.*
alba, *L.*
alpina, *L.*
— var. pyrenaica, *Gouan.*

Rosa, *cont.*
arkansana, *Porter.*
beggeriana, *Schrenk.*
— var. Schrenki.
blanda, *Ait.*
canina, *L.*
carolina, *L.*
— var. nuttalliana.
cinnamomea, *L.*
— var. glandulifolia.
damascena, *Mill.*
Fendleri, *Crépin.*
ferruginea, *Vill.*
gallica, *L.*
hibernica, *Sm.*
hispida, *Sims.*
humilis, *Marsh.*
involuta, *Sm.* var. Wilsoni, *Baker.*
Jundzilli, *Besser.*
lucida, *Ehrh.*
— var. grandiflora.
lutea, *Mill.*
macrophylla, *Lindl.*
— var. parviflora.
Malyi, *Kerner.*
micrantha, *Sm.*
microphylla, *Roxb.*
mollis, *Sm*
moschata, *Mill.*
multiflora, *Thunb.*
nitida, *Willd.*
nutkana, *Presl.*
pisocarpa, *A. Gray.*
pomifera, *Herrm.*
repens, *Scop.*
rubella, *Sm.*
rubiginosa, *L.*
rugosa, *Sieb. & Zucc.*
sericea, *Lindl.*
spinosissima, *L.*
— var. altaica.
— var. fulgens, *Hort.*
— var. myriacantha.
— var. picta, *Hort.*
stylosa, *Desv.*
tomentosa, *Sm.*
webbiana, *Wall.*
wichuraiana, *Crépin.*

Rubus affinis, *Weihe & Nees.*
balfourianus, *Blox.*
Bellardii, *Weihe.*
caesius, *L.*
Colemani, *Blox.*

Rubus, *cont.*
corylifolius, *Sm.*
crataegifolius, *Bunge.*
deliciosus, *James.*
dumetorum, *W. & N.*
echinatus, *Lindl.*
exsecatus, *Muell.*
foliolosus, *D. Don.*
fuscus, *Weihe & Nees.*
glandulosus, *Bell.*
Guentheri, *Weihe & Nees.*
hystrix, *Weihe & Nees.*
Koehleri, *W. & N.*
laciniatus, *Willd.*
leucodermis, *Dougl.*
leucostachys, *Sm.*
lindleyanus, *Lees.*
longithyrsiger, *Lees.*
macrophyllus, *W. & N.*
melanolasius, *Focke.*
micans, *Gren. & Godr.*
mucronatus, *Blox.*
mutabilis, *Genev.*
neglectus, *Peck.*
niveus, *Wall.*
nutkanus, *Moç.*
occidentalis, *L.*
odoratus, *L.*
parvifolius, *L.*
phoenicolasius, *Maxim.*
pubescens, *Auct. Angl.*
Purchasi, *Blox.*
Radula, *Weihe.*
ramosus, *Blox.*
rhamnifolius, *W. & N.*
scaber, *Weihe & Nees.*
spectabilis, *Pursh.*
Sprengelii, *Weihe & Nees.*
suberectus, *Anders.*
thyrsiflorus, *Weihe & Nees.*
thyrsoideus, *Wimm.*
ulmifolius, *Schott.*
villicaulis, *W. & N.*
villosus, *Ait.*
xanthocarpus, *Franch.*

Ruta graveolens, *L.*

Sambucus glauca, *Nutt.*
melanocarpa, *A. Gray.*
nigra, *L.*
racemosa, *L.*
— var. serratifolia.

Skimmia Fortunei, *Mast.* (S. japonica, *Hort.*).

Spartium junceum, *L.*

Spiraea betulifolia, *Pall.*
bracteata, *Zabel.*
canescens, *D. Don.*
discolor, *Pursh.*
Douglasii, *Hook.*
japonica, *L. f.*
— var. glabrata, *Nichols.*
lindleyana, *Wall.*
nobleana, *Hook.*
notha, *Zabel.*
salicifolia, *L.*
sorbifolia, *L.*
tomentosa, *L.*

Staphylea pinnata, *L.*

Symphoricarpus Heyeri, *Dippel.*
mollis, *Nutt.* var. ciliatus, *Nutt.*
orbiculatus, *Moench.*
racemosus, *Michx.*
rotundifolius, *A. Gray.*

Symplocos crataegoides, *Buch-Ham.*

Syringa Emodi, *Wall.*
— var. rosea, *Cornu.*
pekinensis, *Rupr.*
persica, *L.*

Tamarix tetrandra, *Pall.*

Taxus baccata, *L.*
cuspidata, *Sieb. & Zucc.*

Tecoma radicans, *Juss.*

Thuja gigantea, *Nutt.*
japonica, *Maxim.*
occidentalis, *L.*
— var Dicksoni.
orientalis, *L.*

Tilia argentea, *Desf.*
cordata, *Mill.*
petiolaris, *DC.*
platyphyllus, *Scop.*
vulgaris, *Hayne.*

Ulex europaeus, *L.*
nanus, *Forst.*

Ulmus campestris, *L.*

Vaccinium Arctostaphylos, *L.*
corymbosum, *L.*
— var. amoenum, *A. Gray.*
erythrocarpum, *Michx.*
hirsutum, *Buckl.*
ovatum, *Pursh.*
padifolium, *Sm.*
pensylvanicum, *Lam.*

Viburnum acerifolium, *L.*
burejaeticum, *Regel & Herd.*
cassinoides, *L.*
dentatum, *L.*
dilatatum, *Thunb.*
hanceanum, *Maxim.*
Lantana, *L.*
molle, *Michx.*
Opulus, *L.*
prunifolium, *L.*
Tinus, *L.*

Vitis aestivalis, *Michx.*
heterophylla, *Thunb.*
Labrusca, *L.*
riparia, *Michx.*

Widdringtonia Whytei, *Rendle.*

Yucca Whipplei, *Torr.*

Zelkowa acuminata, *Planch.*

Zenobia speciosa, *D. Don.*
— var. pulverulenta.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1898.

NEW GARDEN PLANTS OF THE YEAR 1897.

The number of garden plants annually described in botanical and horticultural publications, both English and foreign, is now so considerable that it has been thought desirable to publish a complete list of them in the *Kew Bulletin* each year. The following list comprises all the new introductions recorded during 1897. These lists are indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, which are, as a rule, only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange with other botanic gardens.

The present list includes not only plants brought into cultivation for the first time during 1897, but the most noteworthy of those which have been re-introduced after being lost from cultivation. Other plants included in the list may have been in gardens for several years, but either were not described or their names had not been authenticated until recently.

In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, with botanical names, and described for the first time in 1897, are included. It has not been thought desirable, however, to give authorities after the names of garden hybrids in such genera as *Cypripedium*, &c. Mere garden varieties of such plants as *Coleus*, *Codiaeum* or *Narcissus* are omitted for obvious reasons.

In every case the plant is cited under its published name, although some of the names are doubtfully correct. Where, however, a correction has appeared desirable, this is made.

The name of the person in whose collection the plant was first noticed or described is given where known.

An asterisk is prefixed to all those plants of which examples are in cultivation at Kew.

15500—1375—1/98 Wt 61 D & S 29 A

The publications from which this list is compiled, with the abbreviation used to indicate them, are as follows:—*B. B.*—Bulletin de L'Herbier Boissier. *B. H. N.*—Bulletin du Museum d'histoire naturelle, Paris. *B. M.*—Botanical Magazine. *Bruant Cat.*—Bruant's Catalogue of New Plants, 1897. *B. T. O.*—Bulletino della R. Società Toscana di Orticultura. *Gard.*—The Garden. *G. C.*—Gardeners' Chronicle. *G. and F.*—Garden and Forest. *Gfl.*—Gartenflora. *G. M.*—Gardeners' Magazine. *G. W.*—Gardening World. *Ill. H.*—L'Illustration Horticole. *Jard.*—Le Jardin. *J. of H.*—Journal of Horticulture. *J. H. F.*—Journal de la Société nationale d'horticulture de France. *J. O.*—Journal des Orchidées. *K. B.*—Bulletin of Miscellaneous Information, Royal Gardens, Kew. *L.*—Lindenia. *Lem. Cat.*—Lemoine, Plantes Nouvelles. *Lind. Cat.*—L'Horticulture Internationale, Catalogue. *M. D. G.*—Mitteilungen der Deutschen Dendrologischen Gesellschaff. *M. G. Z.*—Möller's Deutsche Gärtner-Zeitung. *M. K.*—Monatsschrift für Kakteenkunde. *N. B.*—Notizblatt des Königl. botanischen Garten und Museums zu Berlin. *N. G. M.*—Dr. Neubert's Garten-Magazin. *O. R.*—Orchid Review. *R. H.*—Revue Horticole. *R. H. B.*—Revue de l'Horticulture Belge. *Sand Cat.*—Sanders' Catalogue of New Plants, 1897. *Spaeth Cat.*—L. Spaeth, General Nursery Catalogue. *Veitch Cat.*—Veitch & Sons, Catalogue of Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung.

The abbreviations in the descriptions of the plants are:—*ft.*—Foot or Feet. *G.*—Greenhouse. *H.*—Hardy. *H. H.*—Half-hardy. *in.*—Inches. *S.*—Stove.

Acalypha Chantrieri. (*R. H.* 1897, 402.) Urticaceæ. S. A garden hybrid between *A. hamiltoniana* and *A. macrophylla*. (Chantrier Frères, Mortefontaine, France.)

Acalypha morfontanensis. (*R. H.* 1897, 402.) S. A garden hybrid between *A. hamiltoniana* and *A. marginata*. (Chantrier Frères, Mortefontaine, France.)

Adiantum fasciculatum, Hort. (*G. C.* 1897, xxii., 9.) Filices. S. A variety of *A. cuneatum* with crested fronds. (H. B. May.)

Aglaonema oblongifolium, var. **Curtisii,** N. E. Br. (*G. C.* 1897, xxi., 70.) Aroideæ. S. Differs from the type in having leaves variegated with white along the course of the principal lateral veins. Penang. (J. Veitch & Sons.)

Alnus virescens, Koehne. (Spaeth Cat. 1897-8, 66.) Cupuliferæ. H. A handsome Alder allied to *A. incana*. Colorado. (L. Spaeth, Berlin.)

Alocasia gibba. (*R. H.* 1897, 402.) Aroideæ. S. A garden hybrid between *A. pucciana* and *A. argyræa*. (Chantrier Frères, Mortefnotaine, France.)

Alocasia Gigas, Chantrier. (*R. H.* 1897, 402.) S. A handsome plant with leaves 5ft. high, intense green above, paler beneath. Remarkable for its large size, the deep cutting of the leaves and the pale-green mottled petioles. (Chantrier Frères, Mortefontaine, France.)

Alocasia Uhinki. (J. H. F. 1897, 662.) S. A garden hybrid between *Alocasia metallica* and *Colocasia odora*. (Chantrier Frères, Mortefontaine, France.)

***Androsace macrantha,** Boiss. & Huet. (*Gard.* 1897, lii., 434.) Primulaceae. H. A distinct species, belonging to the *A. septentrionale* group. It forms a large rosette of leaves which are horned near the tip, and bears strong spikes of pure white flowers. Armenia. (Kew.)

Androsace raddiana, Somm. & Levier. (*Jard.* 1897, 378.) H. A pretty biennial species, with rosettes of toothed leaves and rose-coloured flowers. Caucasus. (H. Correvon, Geneva.)

Anemia rotundifolia, Masters. (*G. C.* 1897, xxi., 326.) Filices. S. A new species, with long narrow fronds

formed of sub-rotund pinnæ which are tinted with purple when young. (W. Bull.)

Angraecum mooreanum, Rolfe. (*G. C.* 1897, xxi., 210.) Orchideæ. S. "A pretty little species with salmon-coloured flowers." (Sir T. Lawrence.)

***Anthurium bogotense.** Sander. (*Sand. Cat.* 1897, 3, f.) Aroideæ. S. A robust growing species with a short stem, long slender leaf-stalks and sagittate green leaf-blades. Colombia. (F. Sander & Co.)

Anthurium hanburyanum. (*W. G.* 1897, 256.) S. A garden hybrid of which one of the parents is *A. andreanum.* (Valvassori, Cascine, Florence.)

Anthurium ricasolianum. (*W. G.* 1897, 258.) S. A garden hybrid of which one of the parents is *A. andreanum.* (Marquis Ridolfi, Florence.)

Anthurium ridolfianum. (*W. G.* 1897, 258.) S. A garden hybrid of which one of the parents is *A. andreanum.* (Marquis Ridolfi, Florence.)

Anthurium torrigianum. (*W. G.* 1897, 258.) S. A garden hybrid of which one of the parents is *A. andreanum.* (Marquis Ridolfi, Florence.)

Anthurium Valvassorii. (*W. G.* 1897, 256.) S. A garden hybrid of which one of the parents is *A. andreanum.* (Valvassori, Cascine, Florence.)

***Apera arundinacea,** Hook. (*G. C.* 1897, xxii., 282-283, f. 84.) Gramineæ. An elegant grass, growing about 2 ft. high and producing feathery drooping spikes 4 ft. long. New Zealand. (J. Veitch & Sons.)

***Arabis Sturii,** Hort. (*Gard.* 1897, li., 368.) Cruciferæ. H. A compact growing species, bearing large pure white flowers in early spring. (J. Wood.)

***Arisaema bakeriana,** Sander. (*G. C.* 1897, xxi., 352.) Aroideæ. S. Probably only a small-spathed variety of *A. fimbriatum.* (F. Sander & Co.)

Aristolochia elegans x **brasiliensis.** (*G. C.* 1897, xxii., 126, f. 36.) Aristolochiaceæ. S. A garden hybrid between the two species indicated by the name. (Canon Prettyman.)

***Arum Dioscoridis** var. **spectabile.** (*G. C.* 1897, xxi., 2.) Aroideæ. H. H. This species with much undulated leaves, throws up a flower stem 3 ft. high and bears a spathe 20 in. in length. Col. reddish purple, passing into green above with spots. Asia Minor.

Aruncus sylvester Kneiffi. (*W. G.* 1897, 296; *M. D. Z.* 1897, 260, ff.) Rosaceæ. H. A garden variety of the well-known *Spiræa Aruncus.* (Zabel, Gotha.)

***Asphodeline imperialis,** Siehe. (*G. C.* 1897, xxii., 397, f. 116.) Liliaceæ. H. H. The largest of all the Asphodelines, growing 8 ft. high. Flowers large, reddish white. Asia Minor.

Aster Delavayi, Franchet. (*R. H.* 1897, 27.) Compositæ. H. This species is near *A. Vilmorini,* but differs in having the disk of a permanent violet-brown colour instead of yellow shading off into brown. Yunnan. (M. de Vilmorin, Paris.)

Begonia marginata illustrata. (*Sand. Cat.* 1897, 6.) Begoniaceæ. S. A garden seedling. "The leaves are borne on tall, densely hairy stalks, and are slightly bullate in appearance, the pea-green ground being reticulated with depressed veins of green and chocolate." (F. Sander & Co.)

Begonia Viaudi. (*R. H.* 1897, 561, f. 167.) G. A garden hybrid between *B. Duchartrei* and *B. pictavensis.* (Bruant, Poitiers.)

Bellevallia Heldreichii, Boiss. var. (*G. C.* 1897, xxi., 2.) Liliaceæ. H. A variety with broad leaves and spikes of flowers the colour of *Scilla sibirica.* Asia Minor.

***Berkheya Adlami,** Hook. f. (*B. M.* t. 7514.) Compositæ. G. A new species, and by far the largest known. Stem herbaceous, 6 ft. high, branched; radical leaves 18 in. by 7 in. sinuately lobed and spine-toothed; upper leaves 3–6 in. long, spotted with brown beneath; flower-heads subcorymbose 3½ in. across, yellow. S. Africa. (Kew.)

Billbergia Canterae, Ed. André. (*R. H.* 1897, 60, t.) Bromeliaceæ. S. A handsome plant belonging to the

section *Helicodea.* Inflorescence pendulous shorter than the leaves ; bracts large, deep rose, flowers pale greenish yellow. (Ed. André, Lacroix, Indre-et-Loire.)

Bulbophyllum claptonense, Hort. (*G. C.* 1897, xxi., 294.) Orchideæ. S. A colour variety of *B. Lobbii.* (H. Low & Co.)

Bulbophyllum ptiloglossum, Wendl. & Kränzl. (*G. C.* 1897, xxi., 330.) S. A new species, allied to *B. barbigerum*, from which it differs chiefly in having green and purple flowers with hornless anthers and purplish hairs covering the margins of the distinctly lobed lip. Madagascar. (Herrenhausen.)

***Calochortus clavatus,** S. Wats. (*G. M.* 1897, 392.) Liliaceæ. H. A large flowered, golden yellow coloured species, having a zigzag line of rich brown where the hairy portion commences. Anthers deep purple. California. (R. Wallace & Co.)

Calochortus Plummeræ aurea. (*G. M.* 1897, 454.) H. A variety with golden yellow flowers. Midway down the petal is an irregular scarlet marking across the segment, and below this there are crimson and scarlet dots among the golden hairs. (A near ally of *C. venustus.*) California. (R. Wallace & Co.)

Campanula balchiniana. (*G. and F.* 1897, 214.) Campanulaceæ. H. A beautifully variegated sport from *C. fragilis.* (W. Balchin & Sons.)

Canna indica variegata. Sander. (*G. C.* 1897, xxi., 352.) Scitamineæ. S. A variety with the leaves striped with yellow. Solomon Islands. (F. Sander & Co.)

***Carex Vilmorini,** Mottet. (*R. H.* 1897, 79, f. 26.) Cyperaceæ. G. A graceful species with long very narrow leaves. New Zealand. (Vilmorin, Andrieux & Co., Paris.)

Catasetum splendens Grignani. (*S. H.* 1897, 418.) Orchideæ. S. A form of this natural hybrid, nearly allied to *C. s. lansbergeanum* but with the lip white tinted with orange yellow. (L'Horticulture Internationale, Brussels.)

Catasetum splendens lansbergeanum. (*S. H.* 1897, 418.) S. A form of this natural hybrid with broad white sepals dotted with rose ; lip deep yellow inside, light yellow externally. (L'Horticulture Internationale, Brussels.)

Catasetum splendens rubiginosum. (*L.* 1897, t. 555.) S. A form with sepals and petals of a deep brownish-red, lip deep yellow with lines of reddish-brown dots. (L'Horticulture Internationale, Brussels.)

Cattleya bowringiano - blesensis. (*J. H. F.* 1897, 934.) Orchideæ. A garden hybrid between *C. bowringiana* and *C. blesensis.* (C. Maron, Marseilles.)

Cattleya breauteana. (*J. H. F.* 1897, 934.) A garden hybrid between *C. Loddigesii* and *C. superba.* (C. Maron, Marseilles.)

Cattleya chesnelliana. (*J. H. F.* 1897, 954.) A garden hybrid between *C. bicolor* and *C. bowringiana.* (G. Mantin, Orleans.)

Cattleya dubia. (*J. H. F.* 1897, 934.) A garden hybrid whose supposed parents are *C. Trianæ* and *C. Harrisoniæ.* (C. Maron, Marseilles.)

Cattleya elatior. (*S. H.* 1897, 300.) A garden hybrid between *C. intermedia* and *C. Skinneri.* (G. Mantin, Orleans.)

Cattleya Feuillati. (*J. H. F.* 1897, 933.) A garden hybrid between *C. guttata Leopoldi* and *C. superba.* (C. Maron, Marseilles.)

Cattleya Gaudii. (*J. H. F.* 1897, 934.) A garden hybrid between *C. guttata Leopoldi* and *C. Loddigesii.* (C. Maron, Marseilles.)

Cattleya Gibbonsiae. (*S. H.* 1897, 195.) A garden hybrid between *C. Mendeli* and *C. Loddigesii.* (G. Mantin, Orleans.)

Cattleya Grossii, Kränzl. (*Gfl.* 1897, 113, t. 1436.) Near *C. bicolor*, or possibly a hybrid between *C. bicolor* and *C. guttata.* Origin uncertain. (St. Petersburg, B. G.)

Cattleya hardyana moortebeekiensis. (*S. H.* 1897, 449.) A large-flowered highly-coloured form of this hybrid. (L. Linden & Co., Brussels.)

Cattleya hardyana Reginae. (*S. H.* 1897, 449.) Another form of this

hybrid with the sepals and petals straw yellow. (L. Linden & Co., Brussels).

Cattleya Heloisiae. (*R. H.* 1897, 385.) A garden hybrid between *C. Mossiæ* and *C. Forbesii superba.* (G. Mantin, Orleans.)

Cattleya intermedio — Skinnerii. (*J. H. F.* 1897, 609.) A garden hybrid between the plants indicated by its name. (G. Mantin, Orleans.)

Cattleya labiata superba. (*L.* 1897, t. 560.) Sepals and petals rose shaded with purple; lip large, deep red-purple. (L'Horticulture Internationale, Brussels.)

Cattleya massiliensis. (*R. H.* 1897, 12, t.; *O. R.* 1897, 357.) G. A garden hybrid of which *Laelia crispa* and *C. Trianæ* are the probable parents. The correct name of this is *Laelio-cattleya massiliensis.* (Louis-Fournier, Marseilles.)

Cattleya maxima virginalis. (*L.* 1897, t. 558.) Petals and sepals white, lip blotched and striped with red-purple. (L'Horticulture Internationale, Brussels.)

Cattleya Mendeli Kegeljani. (*L.* 1897, t. 589.) A variety with the flower wholly white with the exception of the disk, which is striped and shaded with sulphur-yellow. (F. Kegeljan, Namur.)

Cattleya olivetensis. (*R. H.* 1897. 353.) A garden hybrid between *C. Loddigesii superba* and *C. maxima peruviensis.* (G. Mantin, Orleans.)

Cattleya Reginae. (*J. H. F.* 1897, 609.) A garden hybrid between *Lælia purpurata blenheimensis* and *Cattleya Forbesii.* (G. Mantin, Orleans.)

Cattleya russeliana. (*R. H.* 1897, 353.) A garden hybrid between *C. labiata Warneri* and *C. schilleriana Regnellii.* (G. Mantin, Orleans.)

Cattleya russelliana major. (*R. H.* 1897. 385.) A garden hybrid between *C. labiata Warneri* and *C. schilleriana.* (G. Mantin, Orleans.)

Cattleya russelliana sulphurea. (*R. H.* 1897. 385.) A garden hybrid between *C. labiata Warneri* and *C. schilleriana.* (G. Mantin, Orleans.)

Cattleya Trianae deliciosa. (*L.* 1897, t. 564.) A form with the lip of a rich purple-red colour, disk golden yellow. (Dr. Capart, Brussels.)

Cattleya Trianae eminens. (*L.* 1897, t. 570.) A form with white sepals, pale rose-coloured petals and a lip with a large carmine-purple blotch margined with white, disk yellow. (L. Linden & Co.)

Cattleya Trianae exornata. (*L.* 1897, t. 556.) Sepals and petals pale rose, lip with an orange-coloured blotch surrounded by red-purple. (L. Linden & Co.)

***Ceropegia Woodii,** Schlechter. (*G. C.* 1897, xxii., 357, f. 104.) Asclepiadeæ. G. A small decumbent or climbing species with thin stems, bearing cordate fleshy grey and green leaves, and axillary flowers an inch long coloured pink and purple. Natal. (Kew and W. Bull.)

***Chionoscilla Alleni.** (*G. C.* 1897 xxi., 191, f. 57.) Liliaceæ. H. A natural hybrid between *Chionodoxa Luciliæ* and *Scilla bifolia.* Its characters are intermediate between the two parents. (Kew.)

***Cineraria Lynchii.** (*G. and F.* x. 44.) Compositæ. G. A garden hybrid between *C. multiflora* and *C. cruenta* var. (Cambridge B. G.)

***Cirrhopetalum Curtisii,** Hook. f. (*B. M.* t. 7554.) Orchideæ. S. A new species, allied to *C. Cumingii,* with a flexuous rhizome, ovoid pseudobulbs ¾ in. long, and linear oblong leaves 4 in. long; scape 4 in. long bearing an umbel of small white, pink and yellow flowers. Malacca. (Kew.)

Cirsium rhizocephalum, C. A. Mey. (*Jard.* 1897, 378.) Compositæ. H. A species with very spiny hairy leaves and stemless heads of yellowish flowers. Caucasus. (H. Correvon, Geneva.)

Cleisostoma zollingerianum, Kränzl. (*G. C.* 1897, xxi., 70.) Orchideæ. S. A new species "of Vanda-like habit, but with very short spikes of only a single flower, which is 1 in. across and white with red-brown spots." Sunda Islands. (Zollinger-Jenny, Zurich.)

Cnicus Provosti, Franchet. (*J. B.* 1897, 43.) Compositæ. H. A near

ally of *C. kamtschaticus*, but differs by its sessile (not amplexicaul) leaves with a rounded base, margins cut as in *C. lanceolatus*. Northern China. (Maurice de Vilmorin, France.)

Cochlioda miniata, L. Lind. (*L.* 1897, t. 562.) Orchideæ. G. Supposed to be a natural hybrid between *C. nötzliana* and *C. vulcanica*. (L'Horticulture Internationale, Brussels.)

Cochlioda stricta, Cogn. (*G. C.* 1897, xxii., 410.) G. A new species, with ovate compressed, bronzy-green pseudobulbs, narrow acute leaves, and a slender erect peduncle, bearing numerous erect rose-coloured flowers smaller than those of *C. rosea* which they otherwise resemble. Colombia. (M. de Lairesse, Liege.)

Colchicum candidum, Schott & Kotschy. (*G. C.* 1897, xxi., 2.) Liliaceæ. H. A free-blooming plant, with delicate white flowers flushed with pale rose. Asia Minor.

Colchicum cilicicum. (*G. C.* 1897, xxi., 2.) H. A species with small rose-coloured flowers tipped with red. Asia Minor.

Colchicum Ritchei, R. Br. (*G. C.* 1897, xxi., 2.) A small-flowered species, the flowers of which appear in spring with the leaves. Asia Minor.

Commelina sellowiana. (*W. G.* 1897, 287, f. 34.) Commelinaceæ. G. A compact-growing species with showy cobalt-blue flowers. Argentina. (Dammann & Co., Naples.)

Cordyline Russelli, Hort. (*G. C.* 1897, xxii., 221.) Liliaceæ. G. A form of *C. australis* with the leaves coloured dull brown, the midrib being yellow. (J. Russell.)

***Coriaria terminalis,** Hemsl. *M.D.G.* 1897, t.) Coriariæ. H. This plant is figured in this work under the name of *C. nepalensis*, Wall.; it differs however from that species in its 5–9-nerved leaves and its terminal inflorescences. Himalaya and China. (Max Leichtlin, Baden Baden.)

***Cotyledon reticulata,** Thunb. (*G. C.* 1897, xxi., 282, f.) Crassulaceæ. G. A species with a gouty stem, fleshy cylindrical leaves and erect corymbs of small whitish flowers, the stalks of which are persistent and become spinous. S. Africa. (Kew.)

Crinum Laurenti, Durand & De Wild. (*R. H. B.* 1897, 97, t.) Amaryllideæ. G. A white flowered species very nearly allied to *C. giganteum*. Congo. (Brussels B. G.)

***Crinum Woodrowi,** Baker, (*G. and F.* 1897, 324.) S. A new species with a large ovate brown bulb, with scarcely any neck, and broad glaucous leaves; scape 2 ft., bearing an umbel of about twelve white long-tubed flowers. Bombay. (Kew.)

***Croton Eluteria,** Benn. (*B. M.* t. 7515.) Euphorbiaceæ. S. The source of the "Cascarilla Bark" of commerce. It was in cultivation a century and a half ago, and after a long interval was again introduced to Kew in 1887. It is a shrub with wiry branches, ovate leaves 2 in. long, grey-green above, silvery beneath, and axillary racemes of small white fragrant flowers. Bahamas. (Kew.)

Croton Warneri. (*R. H.* 1897, 403.) S. Apparently a garden form of *Codiæum variegatum*. (Chantrier frères, Mortefontaine, France.)

Cyclamen colchicum, Alboff. (*Jard.* 1897, 378.) Primulaceæ. H. This differs from *C. europæum* in its larger tubers and leaves, and in the wider and more obtuse petals. Caucasus. (H. Correvon, Geneva.)

Cyclamen Papilio. (*G.* and *F.* x., 46.) G. A seedling sport from *C. latifolium*. (persicum.) (M. de Langhe, Brussels.)

Cymbidium lowianum flaveolum. (*L.* 1897, t. 572.) Orchideæ. S. A form with large flowers light yellow in colour. (L'Horticulture Internationale, Brussels.)

Cypripedium Amandinae. (*R. H.* 1897, 236.) Orchideæ. A garden hybrid between *C. spicerianum* and *C. politum*. (Cambet & Bessy Lyons.)

Cypripedium aurelianum. (*R. H.* 1897, 353.) A garden hybrid between *C. callosum* and *C. javanico-superbum*. (G. Mantin, Orleans.)

Cypripedium Beekmani. (*G. C.* 1897, xxii., 388.) S. "Said to be a hybrid between *C. Boxalli* and *C. bellatulum*."

Cypripedium bellatulo - vexillarium. (*S.H.*, 1897, 238.) A garden hybrid between the two species indicated by the name. (Mrs. Briggs-Bury.)

Cypripedium charpinianum. (*R. H.* 1897, 385.) A garden hybrid between *C. spicerianum* and *C. Morganiæ.* (G. Mantin, Orleans.)

Cypripedium deedmanianum. (*G. C.* 1897, xxii., 388.) S. A garden hybrid between *C. spicerianum* and *C. Chamberlaini.* (Birmingham B. G.)

Cypripedium Duvali. (*J. H. F.* 1897, 465.) A garden hybrid—origin not stated. (G. Mantin, Orleans.)

Cypripedium gibezianum. (*J. H. F.* 1897, 745.) A garden hybrid between *C. venustum* and *C. venosum.* (M. Gibez, Sens, France.)

Cypripedium gratrixianum, Williams. (*O. A.* t. 524.) S. A garden hybrid between *C. bellatulum* and *C. enfieldense.* (S. Gratrix.)

Cypripedium Haynaldo-Chamberlaini. (*G. C.* 1897, xxii., 316.) S. A garden hybrid between the two species indicated by the name. (E. Ashworth.)

Cypripedium Heloisiae. (*R. H.* 1897, 281.) A garden hybrid between *C. gemmiferum* and *C. Boxalli nigrescens.* (G. Mantin, Orleans.)

Cypripedium insigne. (*L.* 1897, t. 563.) G. Three forms of this species are figured here, viz.: *fuscum. immaculatum, picturatum.* (L. Linden & Co., Brussels.)

Cypripedium lawrencianum trieuanum. (*L.* 1897, t. 575.) S. This is a fine form with a large and highly coloured standard; petals very long, and slipper more deeply coloured than usual. (L. Linden & Co., Brussels.)

Cypripedium lebrunianum. (*S. H.* 1897, 458.) A supposed natural hybrid between *C. spicerianum* and *C. purpuratum.* (L'Horticulture Internationale, Brussels.)

Cypripedium macrocarpum. (*R. H.* 1897, 282.) A garden hybrid—parentage not given. (M. Bleu, Paris.)

Cypripedium Margaritae. (*R. H.* 1897, 282.) A garden hybrid between *C. crossianum* and *C. barbatum warnerianum.* (G. Mantin, Orleans.)

Cypripedium nobile. (*R. H.* 1897, 282.) A garden hybrid—parentage not given. (M. Bleu, Paris.)

Cypripedium norrisianum. (*G. W.* 1897, xiv., 148.) S. A garden hybrid between *C. purpuratum* and *C. leeanum.* (F. A. Rehder.)

Cypripedium Pauli. (*L.* 1897, t. 571.) A garden hybrid between *C. insigne Chantini* and *C. villosum Boxalli.* (G. Miteau, Jette-St-Pierre, Belgium.)

Cypripedium rimbertianum. (*R. H.* 1897, 281.) A garden hybrid between *C. ciliare* and *C. Hookeræ luteum.* (G. Mantin, Orleans.)

Cypripedium russellianum. (*R. H.* 1897, 281.) A garden hybrid between *C. swannianum* and *C. spicerianum magnificum.* (G. Mantin, Orleans.)

Cypripedium senonense. (*J. H. F.* 1897, 745.) A garden hybrid between *C. villosum* and *C. Lowii.* (M. Gibez. Sens, France.)

Cypripedium Simonei. (*J. H. F.* 1897, 944.) A garden hybrid between *C. leeanum* and *C. insigne Chantini.* (M. Courmontagne, Paris.)

***Cypripedium spectabile** var. **album.** (*G. and F.* 1897, 216.) G. A variety with pure white flowers. (Kew.)

Cypripedium Vipani Corningii. (*O. R.* 1897, 241, f. 11.) S. A garden hybrid of doubtful parentage. (E. Corning, New York.)

***Cytisus kewensis.** (*G. C.* 1897, xix., 698.) Leguminosæ. H. A garden hybrid between *C. Ardoini* and *C. albus.* (*Kew.*)

Delphinium speciosum var. **glabratum,** Stapf. (*G. C.* 1897, xxii., 307.) Ranunculaceæ. H. Similar in growth and flowers to *D. cashmirianum,* but with larger inflorescences and longer spurs to its flowers. Himalaya. (Haage & Schmidt, Erfurt.)

Dendrobium Backhousei. (*O. R.* 1897, 110, 146.) Orchideæ. S. A garden hybrid between *D. tortile* and *D. thyrsiflorum.* (J. Backhouse & Son.)

Dendrobium barbatum, Cogn. (*G. C.* 1897, xxii., 394.) S. A new species.

allied to *D. ciliatum*, with short pseudobulbs, bearing six or seven lanceolate linear green leaves about 2in. long; racemes terminal, short, 4-5 flowered; flowers white, lip three-lobed, edged with long flexuous hairs. Burma. (M. de Larisse, Liege.)

Dendrobium burberryanum. (*G. C.* 1897, xxi., 115; *O. R.* 1897, 80. S. A garden hybrid between *D dominianum* and *D. findlayanum*. (J. Chamberlain.)

Dendrobium coeleste, Loher. (*G. C.* 1897, xxii.) S. A new species. "The fleshy flowers are dark blue, the ovary and spur purple; sepals and petals ovate, sub-equal; lip obovate, blunt." ? Philippines.

Dendrobium greatrixianum. (*G. C.* 1897, xxii., 222.) S. "A pretty slender species with white flowers and a large ovate labellum with a blotch of purple at the base and apex." New Guinea. (F. Sander & Co.)

Dendrobium nobile virginale. (*O. R.* 1897, 145, f. 8.) S. A variety with pure white flowers, save a tinge of pale primrose on the labellum. (F. Sander & Co.)

Dendrobium papilio, Loher. (*G. C.* 1897, xxi. 416.) S. A new species, allied to *D. crumenatum*. Stems thin and grass-like; flowers large, solitary pale rose-coloured, fragrant, pendant, lip wavy, purple veined. ? Philippines.

* **Dendrobium sarmentosum,** Rolfe. (*B. M.* t. 7527.) S. Habit of, and allied to, *D. barbatulum*. Stems very slender, 18 in. long, branched; leaves produced before the flowers, the latter being solitary or two or three together, 1 in. across, white with a yellow blotch and a few lines of crimson at the base of the labellum. Burma. (Kew.)

Dendrobium taurinum var. **amboinense,** Rolfe. (*O. R.* 1897, 304.) S. A variety with flowers coloured yellow, spotted with brown, the type being white and purple. Ambcyna. (J. Veitch & Sons.)

Dendrobium Victoriae Reginae, Loher. (*G. C.* 1897. xxi. 399, xxii. 121, f. 34.) S. A new species. "Its branching stems produce great numbers of rich dark blue and white flowers in trusses; the sepals white, blotched with blue, the oblong lip blue. Philippines. (T. Statter.)

* **Deutzia corymbiflora.** (*R. H.* 1897 486.) Saxifrageæ. A shrub with slender branches, yellowish-grey bark, ovate-lanceolate acute deep green, tomentose, somewhat rough leaves, and erect panicles of small white flowers. Western China. This plant has been referred by Franchet to his *D. setchuenensis*. (Maurice L. de Vilmorin, France.)

* **Diervilla praecox,** Lemoine. (*Gfl.* 1897, 393, t. 1441.) Caprifoliaceæ. H. A. Japanese species nearly allied to D. *amabilis* and *D. florida*. (Lemoine, Nancy.)

* **Dimorphotheca Ecklonis,** D. C. (*B. M.* t. 7535.) Compositæ. G. A herbaceous perennial with subsessile lanceolate toothed leaves 5 in. long and erect axillary scapes; flower-heads 3 in. across, ray-florets purple outside, ivory white inside, disk violet. S. Africa. (Kew.)

Diplacus tomentosus. (*W. G.* 1897, 66.) Scrophularineæ. H. This differs from *D. glutinosus* in its bright green leaves which are clothed beneath with a white wool, as are the calyx and young stems. California. (Lemoine, Nancy.)

Dipladenia speciosa, Hort. (*Sand. Cat.* 1897, 12, f.) Apocynaceæ. S. Said to be a garden hybrid between *D. brearleyana* and an unnamed species. (F. Sander & Co.)

Dombeya Cayeuxii. (*R. H.* 1897, 544, t.) Sterculiaceæ. S. A garden hybrid between *D. Mastersii* and *D. Wallichii*. (Lisbon B. G.)

Doryopteris Duvalii. (*R. H.* 1897, 563, f. 168.) Filices. G. A garden hybrid between *D. sagittifolia* and *D. palmata*. (Duval, Versailles.)

Draba scabra, C. A. Meyer. (*Jard.* 1897, 378.) Cruciferæ. H. A pretty rock plant with glossy green juniper-like leaves and yellow flowers. Caucasus. (H. Correvon, Geneva.)

* **Drimia Coleae,** Baker. (*B. M.* t. 7565.) Liliaceae. S. A new species with a large globose brown bulb, oblong leaves 8 in. by 3 in., pale glaucous green spotted with darker green; spike erect 8 in. long, spotted with brown and bearing numerous flowers ½ in. long with reflexed greenish segments and purple anthers. Somaliland. (Kew.)

Echinocactus schilinzkyanus, Ferd. Haage. (*M. K.* 1897, 108.) Cacteæ. G. Plant globose or very shortly cylindrical; ribs hardly developed; spines short. In general aspect this plant resembles *E. pumilus*. Paraguay. (Haage, Junr., Erfurt.)

Echinocereus Hempelii, F. Fobe. (*M. K.* 1897, 187, f.) Cacteæ. A species with dark green ten-ribbed stems and brownish spines. Mexico. (F. Fobe-Ohorn, Germany.)

Echinopsis Pentlandii var. **ochroleuca**, R. Mey. (*M. K.* 1897, 54, f.) Cacteæ. G. A variety differing from the type in its yellowish-white flowers. (Hildmann, Berlin.)

Epicattleya matutina. (*G. C.* 1897, xxi., 210, 233, f. 77.) Orchideae. S. A garden hybrid between *Epidendrum radicans* and *Cattleya bowringiana*. (J. Veitch & Sons.)

Epidendrum radico-vitellinum, Hort. (*G. C.* 1897, xxii., 16.) Orchideæ. G. A garden hybrid between the two species indicated by the name. (J. Veitch & Sons.)

Epidendrum stanhopeanum, Kränzl. (*G. C.* 1897, xxii., 29.) G. A new species, allied to *E. carinatum*, having short thin stems, small leaves and terminal racemes of small green and purple flowers. Colombia.

Epilaelia bellaerensis. (*R. H.* 1897, 353.) Orchideæ. G. A garden hybrid between *Laelia autumnalis* and *Epidendrum ciliare*. (G. Mantin, Orleans.)

Epilaelia radico-purpurata. (*G. C.* 1897, xxii, 61, 83, f. 23.) A garden hybrid between *Epidendrum radicans* and *Laelia purpurata*. (J. Veitch & Sons.)

Eremurus bucharicus, Regel. (*Gard.* 1897, li., 396.) Liliaceæ. H. This Central Asian species is here mentioned as being in flower in the garden of A. K. Bulley.

Eriopsis Helenae, Kränzl (*G. C.* 1897, xxii., 98.) Orchideæ. S. A new species and the finest of the genus. Pseudobulbs 16 ins. long; leaves linear lanceolate; scape 20 ins. long bearing several flowers which are not unlike those of *E. biloba*, but twice as large. Peru. (F. Sander & Co.)

***Erodium chrysanthum**, L'Her. (*Gard.* 1897, lii., 208.) Geraniaceæ. H. A very distinct species with finely cut silvery foliage and lemon yellow flowers. Greece. (A. K. Bulley.)

***Erythronium Johnsoni**, Boland. (*Gard.* 1897, li., 136. f.) Liliaceæ. H. A distinct species with scapes 10 to 12 inches high, bearing flowers of a reddish pink hue, deeper on the outside, together with a zone of orange yellow at the base of the petals. Oregon. (R. Wallace & Co.)

***Erythronium revolutum**, Smith. (*G. M.* 1897, 220, 270.) A species with marbled leaves; the flowers, which vary in colour from white to rose, are borne on scapes about 1 ft. high. N. America. (R. Wallace & Co.)

***Escallonia langleyensis.** (*G. C.* 1897, xxii., 17, f. 4.) Saxifrageæ. H. A garden hybrid between *E. phillipiana* and *E. macrantha*. (J. Veitch & Sons.)

Eugenia Guabiju, E. André. (*R. H.* 1897, 304, t.) Myrtaceæ. G. A glabrous shrub or small tree with dark green leathery leaves, greenish-white flowers and blue-black edible fruits about the size of a cherry. Uruguay. (Ed. André, France.)

Ficus radicans variegata, Bull. (*G. C.* 1897, xxii., 149.) Urticaceæ. S. A variety with leaves margined with creamy-white. (W. Bull.)

***Fritillaria pluriflora**, Torr. (*G. C.* 1897, xxi., 231, f. 76.) Liliaceæ. H. A distinct plant, about a foot high, bearing several reddish purple nodding flowers on long pedicels. California. (Kew.)

***Fritillaria sieheana**, Hausskn. (*G. C.* 1897, xxi., 16.) H. A species growing about 1½ feet high, bearing large green and striped red flowers. Asia Minor.

***Fritillaria Walujewi**, Regel. (*Gard.* 1897, lii., 244, t. 1137.) H. A showy plant is here figured. Fls. whitish on the outside, shaded with dove colour inside, white marks on crimson ground. Turkestan. (Barr & Sons.)

***Fuchsia triphylla superba.** (*G. C.* 1897, xxii., 221.) Onagrarieæ. G. Probably a chance hybrid between *F. triphylla* and *F. corymbiflora*. The

flowers are larger and different in colour from those of *F. triphylla*. (R. Veitch & Son.)

Galanthus cilicicus, Baker. (*G. C.* 1897, xxi., 214.) Amaryllideæ. H. A species closely allied to *G. Fosteri*, but differing in its less robust habit, much narrower leaves, and absence of the large green blotch on the lower half of the inner segments of the perianth. Cilician Taurus. (T. S. Ware.)

Galanthus Nicana. (*Gard.* 1897, li., 283.) Liliaceæ. H. A late flowering, distinct snowdrop with broad short foliage. Doubtless *G. Ikariæ*, Baker, is the plant meant. (J. Wood.)

Gazania nivea grandiflora. (*R. H.* 1897, 351.) Compositæ. H. A garden hybrid between *G. splendens* and *G. nivea*. (Lemoine, Nancy.)

***Gazania nivea latiflora.** (*Gard.* 1897, lii., 277.) Compositæ. G. A form with large whitish or cream coloured flowers. (Kew.)

Geum speciosum, Alboff. (*Jard.* 1897, 378.) Rosaceæ. H. A tall-growing species with orange-yellow flowers. Caucasus. (H. Correvon, Geneva.)

***Gladiolus fusco-viridis,** Baker. *Flora Capensis*, vi., 530.) Irideæ. G. A new species near *G. dracocephalus*. Leaves ensiform, 15 in. long, 1 in. wide: stem 2 ft. long, bearing 12 flowers 2 in. long, greenish with minute stripes of claret-brown. S. Africa. (Kew.)

***Gomphocarpus setosus,** Br. (*B. M.* t. 7536.) Asclepiadeæ. G. Allied to *G. fruticosus*, but with glabrous greenish-yellow flowers. It forms a small shrub with narrow lanceolate glabrous pale green leaves and bears numerous umbels of flowers about the apex of the branches. S. Arabia. (Kew.)

Gymnogramme sprengeriana. (*W. G.* 1897, 257.) Filices. S. A garden hybrid between *G. argentea* and *G. laucheana*. (Ragionieri, Montall Angliana, Tuscany.)

Habenaria Ellioti, Rolfe. (*G. C.* 1897, xxi., 407.) Orchideæ. S. Leaves lanceolate, bright green, luxuriant on a strong stem; flowers green, spur long and thin. Madagascar. (Herrenhausen.)

***Habenaria rhodocheila,** Hance. (*B. M.* t. 7571.) S. A near ally of *H. militaris*. Tuber cylindric, fleshy: lower leaves oblong, acuminate. 6 ins. long. upper smaller; stem, including raceme. a foot high; flowers 1 in. long. sepals and petals small, green; lip large, four-lobed scarlet; spur 2 ins. long, yellow. S. China. (Kew.)

Haemanthus longipes, Engl. (*N. B.* 1897, 290, t.) Amaryllideæ. S. A species with cinnabar-red flowers allied to *H. rupestris*. Cameroons. (Berlin B. G.)

Helianthus Ligeri. (*J. H. F.* 1897. 741.) Compositæ. H. A garden hybrid between *H. rigidus* and *H. laetiflorus*. (M. Millet fils, Bourg-la-Reine, near Paris.)

Heliopsis pitcheriana. (*G. M.* 1897, 465.) Compositæ. H. A form of *H. scabra* with rich orange flowers. (G. Paul & Son.)

Hemerocallis citrina, Baroni. (*B. T. O.* 1897, 160, t. 7.) Liliaceæ. H. This species, with lemon-yellow flowers, differs from *H. minor* in having leaves twice as broad and much larger flowers; from *H. Dumortieri* in the longer scape, by its leaves being three times as long: by the longer tube and the flowers twice the size. China. (Florence B. G.)

Hemerocallis flavo-Middendorffii. (*R. H.* 1897, 247.) H. A garden hybrid between the two species indicated by the name. (Dr. H. Christ, Basle.)

Hemerocallis fulva var. **maculata,** Baroni. (*B. T. O.* 1897, 175.) H. A form differing from the type in having a deltoid reddish-purple blotch on the inside of the flower. North-western China. (Florence B. G.)

***Hemipilia amethystina,** Rolfe. (*B. M.* t. 7521.) Orchideæ. S. A new species, with a small fleshy tuber. bearing a solitary ovate, cordate leaf, 4 ins. long, yellow-green, marbled with brown. Scape erect, 8 ins. long, bearing numerous Ophrys-like flowers, ½ in. across, white and purple. Burma. (Kew.)

***Heracleum mantegazzianum,** Levier & Somm. (*Jard.* 1897, 377.) Umbelliferæ. H. A gigantic Cow-parsnip with umbels a yard and a half across. Caucasus. (H. Correvon, Geneva).

***Heuchera brizoides.** (*W. G.* 1897, 66.) Saxifrageæ. H. A garden hybrid between *Tiarella purpurea* and *Heuchera sanguinea*. (M. Lemoine, Nancy.)

***Holothrix orthoceras,** Reichb. f. (*B. M.* t. 7523.) Orchideæ. G. A small terrestrial orchid with a pair of annual leaves, ovate, 2 in. long, green with grey reticulations; scape erect, 6 in. long, purple, bearing numerous small flowers, which are white striped with purple. S. Africa. (Kew.)

Ipomoea gossypioides. (*W. G.* 1897, 26, f. 9.) Convolvulaceæ. G. An annual, non-climbing species with long-stalked green leaves and showy rose-coloured flowers with red-purple throat. Southern Argentina. (Dammann & Co., Naples.)

Ipomoea imperialis aurata. (*B. T. O.* 1897, 52, f. 7.) H. H. "A vigorous climber, with golden leaves and blue or rosy-lilac flowers." (Dammann & Co., Naples.)

Ipomoea imperialis collata. (*B. T. O.* 1897, 53, f. 8.) H. H. A form with variable-coloured flowers, the corollas with wavy, crimped margins. (Dammann & Co., Naples.)

Ipomoea perringiana, Dammer. (*G. C.* 1897, xxii., 410.) S. A new species with slender climbing stems, covered with stellate hairs; leaves petiolate ovate, lobed at the base; flowers hypocrateriform, 3 in. long, violet-rose. Cameroons. (Berlin B. G.)

Iris germanica maxima. (*G. M.* 1897, 387.) Irideæ. H. A large form of this species, with rich blue falls and pale blue standards. (T. S. Ware.)

Iris lupina lurida. (*W. G.* 1897, 245, t. iii.) H. A variety of this rare Oncocyclus Iris with limb of ashy-grey, instead of yellowish green ground colour. Armenia. (Dammann & Co., Naples.)

Iris persica vogeliana. (*G. C.* 1897, xxii., 426.) H. A variety with silver-grey flowers, the segments having a large claret-coloured spot. (Herb & Wulle, Naples.)

Iris Rudini. (*W. G.* 1897, 296.) H. A garden hybrid between *I. atropurpurea* and *I. Lorteti*. (Herb & Wulle, Naples.)

***Kalanchoe flammea,** Stapf. (*K. B.* 1897, 266; *G.* and *F.* 1897, 293.) Crassulaceæ. G. A new species allied to *K. glaucescens*, having shorter spathulate fleshy crenate leaves, on stems about a foot high, and an erect long-stalked corymbose cyme of numerous tubular bright scarlet flowers. Somaliland. (Kew.)

***Kniphofia breviflora,** Harv. (*B. M.* t. 7570.) Liliaceæ, G. A near ally of *K. modesta* from which it differs chiefly in having bright yellow instead of white flowers; leaves linear 2 ft. long; peduncle erect, 2 ft. long bearing a raceme 4 in. long, of short tubular flowers. Natal. (Kew.)

***Kniphofia primulina,** Baker. (*Flora Capensis*, vi., 533; *G.* and *F.*, x., 74.) G. A new species near *K. natalensis*. It has leaves 3 ft. long and 1 in. wide; scape 3 ft. high bearing a raceme 6 in. long of tubular primrose-yellow flowers. Natal. (Kew.)

Laelia anceps kienastiana. (*G. C.* 1897, xxi., 115.) Orchideæ. G. A variety with the front lobe and edges of the lip coloured dark rose. (I. Brandt, Zurich.)

Laelio-cattleya behrensiana inversa. (J. H. F. 1897, 609.) Orchideæ. G. A garden hybrid between *Cattleya Loddigesii superba* and *Laelia elegans colorata*. (G. Mantin, Orleans.)

Laelio-cattleya broomeana, J. O'Brien. (*G. C.* 1897, xxii., 174.) G. Allied to *L. elegans*. Flowers 6 in. across, sepals 1 in. wide, petals ovate, lip broad, flat; colour rosy-mauve with a crimson-purple blotch on front lobe of lip. Brazil. (J. Broome.)

Laelio-cattleya digbyana-Trianae. (*G. C.* 1897, xxi., 261.) S. A garden hybrid between the plants indicated by the name. (J. Veitch & Sons.)

Laelio-cattleya Margaritae. (*J. H. F.* 1897, 437.) A garden hybrid between *Laelia grandis* and *Cattleya Mossiae*. (G. Mantin, Orleans.)

Laelio-cattleya olivatensis. (*R. H.* 1897, 282.) A garden hybrid between *Laelia anceps morada* and *Cattleya bowringiana*. (G. Mantin, Orleans.)

Laelio-cattleya parisiensis. (*S. H.* 1897, 150; *N. G. M.* 1897, 244.) A

garden hybrid between *Cattleya Warneri* and *Laelia purpurata*. (M. Alfred Bleu, Paris.)

Laelio-cattleya Reginae. (*S. H.* 1897, 300.) A garden hybrid between *Laelia purpurata* and *Cattleya Forbesi*. (M. Mantin, Orleans.)

Laelio-cattleya stelzneriano-hardyana. (*J. H. F.* 1897, 935.) A garden hybrid between the plants indicated by the name. (C. Maron, Marseilles.)

Laelio-cattleya Thorntoni. (*O. R.* 1897, 339.) G. A garden hybrid between *Laelia digbyana* and *Cattleya gaskelliana*. (T. W. Thornton.)

Laelio-cattleya tyntesfieldensis. (*O. R.* 1897, 169.) G. A garden hybrid between *Laelia purpurata* and *Cattleya dowiana*. (G. W. Law Schofield.)

Laeliodendrum bellaerense. (*J.H.F.* 1897, 602.) [*See* **Epilaelia bellaerensis.**]

Laeliodendrum Margaritae. (*J.H.F.* 1897, 1245.) Orchideæ. A garden hybrid between *Laelia grandis* and *Epidendrum falcatum* or *E. parkinsonianum*. [This is an Epilaelia.] (G. Mantin, Orleans.

Lapageria rosea Ilsemanni. (*Gfl.* 1897, 617, t. 1445.) Liliaceæ. G. A free-flowering vigorous form with larger and more brightly coloured flowers than those of the type. (F. Sander & Co.)

Lavatera crestiana. (*G. C.* 1897, xxi., 9; *R. H.* 1897, 351.) Malvaceæ. H. A garden hybrid between *L. trimestris* and *L. maritima*. (Micheli, Geneva.)

Leptosyne Stillmani, A. Gray. (*Gfl.* 1897, 612, f. 83.) Compositæ. H. A beautiful annual with yellow flower-heads and leaves with linear lobes. California. (Ernst Benary, Erfurt.)

***Linaria antirrhinifolia,** Hort. (*Gard.* 1897, lii., 388.) Scrophularineæ. H. A dwarf spreading plant 6 to 8 inches high, the purple flowers being arranged in racemes, very free. Spain. (R. Veitch & Sons.) [This is the same as *L. antirrhinoides*, Coss. a syn. of *L. Cavanillesii*, Chav.]

Lobelia Rivoirei, Hort. (*G. C.* 1897, xxii., 426.) Campanulaceæ. H. A perennial with clear rose-coloured flowers. (Rivoire & Son, Lyon.)

Lomaria ciliata grandis. (*G. and F.* 1897, 204.) Filices. S. A variety with pinnæ as wide as in *Blechnum brasiliense*. (T. May.)

Lonicera thibetica, Bur. & Franch. (*J. H. F.* 1897, 743.) Caprifoliaceæ. H. A small-leaved bush honeysuckle of compact habit, leaves dark green above, glaucons beneath; flowers fragrant, small, rose-tinted. Western China. (Maurice L. de Vilmorin, Les Barres, France.)

Lüddemannia sanderiana, Kränzl. (*G. C.* 1897, xxii., 138.) Orchideæ. S. A new species resembling *L. Lehmanni*, differing in the cream colour of its flowers, especially in the lip, which is white with purple blotches and a cushion-like hairy callosity of the darkest purple. Colombia. (F. Sander & Co.)

Lycaste Mantini. (*S. H.* 1897, 110.) Orchideæ. G. A garden hybrid between *L. Skinneri* and *L. Deppei*. (G. Mantin, Orleans.)

Mamillaria hirschtiana. (*N. G. M.* 1897, 154.) Cacteæ. G. A very spiny species with numerous large flowers from rose to dark red in colour. (F. C. Heinemann, Erfurt.)

***Mapania pandanifolia,** Hort. (*G. C.* 1897, xxi., 353; *Sand. Cat.* 1897, 14. f.) Cyperaceæ. S. Leaves arching, green, 2 ft. long, 1½ in. wide. Grows to a height of about four feet. Habitat not recorded. (F. Sander & Co.)

Maranta Chantrieri, Ed. André. (*R. H.* 1897, 401; *J. H. F.* 1897, 662.) Scitamineæ. S. A handsome species with grey-green wavy leaves traversed by oval-oblong acute bands of deep green and thread like lines of the same colour. Brazil. (Chantrier frères, Mortefontaine, France.)

Maranta minor, Chantrier. (*R. H.* 1897, 403.) S. A small-growing species with subcordate emerald-green leaves, bearing six distant blotches of deep red-brown. Brazil. (Chantrier frères, Mortefontaine, France.)

Maranta picta, Hort. (*G. C.* 1897, xxii., 293.) S. A tufted plant, with elegant broadly-lanceolate leaves a

foot long, deep green with an irregular area of greenish yellow running along the midrib. Under side coloured deep purple. (W. Bull.) [This is probably a Calathea.]

Marattia Burkei, Baker. (*G. C.* 1897, xxii., 425, f. 129.) Filices. S. A new species, allied to *M. alata.* Stock stout, prickly, green, above a foot long; frond square tripinnate, above a foot long and wide, bright green; pinnæ in four opposite pairs; pinnules crowded, lanceolate, 1½ in. long, crenate. Colombia. (J. Veitch & Sons.)

Maxillaria elegantula, Rolfe. (*G. C.* 1897, xxii., 388, 420, f.) Orchideæ. G. A new species, allied to *M. fucata*, having yellow and white segments spotted with brown. (F. Sander & Co.)

Melocactus humilis, Suringar. (*Gfl.* 1897, 281, t. 1439.) Cacteæ. G. A low-growing, depressed-ovate, grey-green species with carmine-red flowers. Venezuela. (Dammann & Co., Naples.)

Miltonia Binoti, Cogn. (*G. C.* 1897, xxii., 393.) Orchideæ. G. A new species "recalling some forms of *M. candida*, the pseudobulbs, leaves and size and form of flowers being nearly identical with those of that species. The sepals and petals are cinnamon-brown, with the apex, a narrow margin, and one or two imperfect transverse bars of pale greenish yellow; lip violet purple." Brazil. (A. Peeters, Brussels.)

Miltonia leopoldiana. (*Gfl.* 1897. 508.) G. Bright rose with dark blotch. Colombia. [Probably *M. vexillaria Leopoldii.*] (A. A. Peters, Brussels.)

Miltonia peetersiana. (*G. C.* 1897, xxii., 222.) G. Said to be a natural hybrid between *M. spectabilis moreliana* and *M. Clowesii.* (R. J. Measures.)

Miltonia vexillaria. (*L.* 1897, t. t. 579-80.) Several varieties are here figured under the names *alba*, *bellatula*, *gloriosa*, *lineata* and *tricolor.* (L. Linden & Co.)

Miltonia vexillaria bousiesiana. (*S. H.* 1897, 150.) This differs from the type in having large deep purplish-red flowers. (L'Horticulture Internationale, Brussels.)

Miltonia vexillaria kirsteiniae. (*L.* 1897, t. 588.) In this form the sepals and petals are rose-tinged except at base, where they are rose-purple; lip white, disk yellow, the three teeth of the crest red-purple. (L. Linden & Co., Brussels.)

Miltonia vexillaria quadricolor. (*S. H.* 1897, 238.) A form with white-margined rose-coloured sepals, white-bordered petals with an intense rose-purple base, and a large yellow disk. (L'Horticulture Internationale, Brussels.)

Miltonia vexillaria vittata. (*L.* 1897, t. 576.) A form with sepals and petals deep rose at the base changing to pale rose in the centre, and nearly white at the tips. (L'Horticulture Internationale, Brussels.)

Mormodes ladium, Rolfe. (*G. and F.* x., 54.) Orchideæ. S. A new species near *M. igneum.* It has an erect scape 1 ft. long, bearing about a dozen large dull red flowers with a yellowish-brown lip. Peru. (Hon. W. Rothschild.)

Mulgedium albanum, D.C. (*Jard.* 1897, 378.) Compositæ. H. A perennial species with panicles of azure-blue flower heads. Caucasus. (H. Correvon, Geneva.)

***Myrmecodia Antoinii,** Beccari. (*B. M.* t. 7517.) Rubiaceæ. S., Tuberous base of stem 20 in. in circum. covered with spines; upper portion 9 in. long, 1½ in. in dia., covered with imbricating woody shields; leaves elliptic-ovate 4 in. long, bright green; flowers small, white. Torres Straits. (Kew.)

Mystacidium hariotianum, Kränzl. (*J. B.* 1897, 153.) Orchideæ. S. A near ally of *M.* (*Aeranthus*) *erythropollinium* and *M. xanthopollinium*, differing from the latter in the racemes being longer than the leaves in its longer sepals and blunt spur, &c., and from the former in its simply bilobed obtuse leaves and by its entire lip. Flowers minute. Madagascar. (Luxemburg Garden, Paris.)

Nepenthes Tiveyi. (*G. C.* 1897, xxii., 201, ff. 59, 60.) Nepenthaceæ. S. A garden hydrid between *N. Veitchii* and *N. Curtisii superba.* (J. Veitch & Sons.)

* **Nepenthes Wittei.** (*Veitch Cat.* 1897, 7.) S. A garden hybrid between *N. Curtisii* and an unnamed species. (J. Veitch & Sons.)

Nidularium versaillense. (*J. H. F.* 1897, 545.) Bromeliaceæ. S. A garden hybrid between *N. Meyendorfi* and *N. princeps.* (A. Truffaut, Versailles.)

Nymphaea ellisiana, E. André. (*R. H.* 1897, 513.) Nymphæaceæ. H. Flowers four inches or rather more in diameter, petals bright scarlet, stamens with broad filaments of a bright orange colour. Garden origin. (Latour-Marliac, Temple-sur-Lot, France.)

Nymphaea Greyae. (*N. G. M.* 1897, 187.) G. A garden hybrid between *N. scutifolia* and *N. gracilis.*

Nymphaea gloriosa, E. André. (*R. H.* 1897, 513.) H. Flowers large, upwards of 6 in. in diameter, brilliant carmine-red in colour. Garden origin. (Latour-Marliac, Temple-sur-Lot, France.)

Nymphaea odorata exquisita. (*R. H.* 1897, 513.) H. Flowers three inches or rather more in diameter, petals a beautiful soft rose colour—paler towards the centre—filaments pale yellow, anthers yellow, stigmatic crown pale yellow. Garden origin. (Latour-Marliac, Temple-sur-Lot, France.)

Nymphaea zanzibarensis azurea. *R. H.* 1897, 328, t.) G. A garden form with coarsely toothed glossy leaves, spotted with deep violet; flowers blue-violet, stamens with yellow filaments and violet anthers. (Latour-Marliac, Temple-sur-Lot, France.)

Odontoglossum Adrianae. (*L.* 1897, t. 590.) Orchideæ. G. A garden hybrid between *O. crispum* and *O. hunnewellianum.* (L. Linden & Co., Brussels.)

Odontoglossum andersonianum bogaerdeanum. (*O. R.* 1897, 305, f. 14.) G. A variety with broad segments, coloured light yellow, tinted with rose and heavily blotched with brown. (De B. Crawshay.)

Odontoglossum cirrho-Halli. (*L.* 1897, t. 569.) A garden hybrid between the species indicated by the name. (L'Horticulture Internationale, Brussels.)

Odontoglossum crispum heliotropium. (*G. C.* 1897, xxi., 293.) G. A variety with large rose-tinted purple spotted flowers. (R. B. White.)

Odontoglossum crispum Kegeljani. (*L.* 1897, t. 565.) G. A form with the flowers copiously spotted and blotched with reddish-brown. (L. Linden & Co., Brussels.)

Odontoglossum crispum Lindeni. (*L.* 1897, t. 567.) A form with the blotches of the petals red and those of the other parts of the flower brown. (L. Linden & Co., Brussels.)

Odontoglossum crispum Luciani. (*L.* 1897, t. 568; *G. C.* 1897, xxi., 210.) A variety with large well-formed flowers, white tinged with rose and marked with large purple-brown blotches. (L'Horticulture Internationale, Brussels.)

Odontoglossum crispum moortebeekiense. (*S. H.* 1897, 258, f. 103; *L.* 1897, t. 581.) A form with large purple-red blotches on the petals. (L'Horticulture Internationale, Brussels.)

Odontoglossum crispum spectabile. (*L.* 1897, t. 552.) G. A form with large chestnut-brown blotches. (L. Linden & Co., Brussels.)

Odontoglossum dayanum. Rchb. f. (*G. C.* 1897, xxii., 388.) G. Similar to *O. praestans,* with large cream-white flowers profusely spotted with cinnamon-brown, lip white and pale mauve. (Baron Sir H. Schroeder.)

Odontoglossum excellens Lowiae. (*G. C.* 1897, xxi., 294.) G. A variety with bright yellow flowers spotted with brown. (H. Low & Co.)

Odontoglossum luteo-purpureum cornutum. (*L.* 1897, t. 584.) A form with flowers having large horn-like teeth. (L'Horticulture Internationale, Brussels.)

Odontoglossum Pauwelsiae, Hort. (*G. C.* 1897, xxi., 210.) G. One of the *O. andersonianum* group, with creamy-white, brown spotted flowers. (L'Horticulture Internationale, Brussels.)

Oncidium Phalaenopsis excellens. (*L.* 1897, t. 553.) Orchideæ. A form having a deeper violet-coloured tint and larger blotches than the type. (L'Horticulture Internationale, Brussels.)

Oncidium sarcodes punctulatum. (*L.* 1897, t. 577.) G. A form mainly differing from the type in having the lip dotted with bright brown-red points. (L'Horticulture Internationale, Brussels.

***Ornithogalum Haussknechtii.** (*G. C.* 1897, xx., 85.) Liliaceæ. H. A species of dwarf habit, similar to *O. oligophyllum.* Asia Minor.

***Passiflora pruinosa,** Masters. (*G. C.* 1897, xxii., 393, f. 117.) Passifloreæ. S. A new species belonging to the Granadilla section, with glabrous, palmately three-lobed dark green leaves, large stipules and solitary axillary flowers, 3 in. across; sepals and petals white, corona composed of numerous wavy threads, coloured white, yellow and blue. British Guiana. (Kew, and F. Sander & Co.)

Perilla nankinensis rosea. (*B. T. O.* 1897, 202.) Labiatæ. A form with leaves variegated with red, rose, light green and whitish. (Francesco Biego, Vicenza.)

***Petasites japonicus,** F. Schmidt. var. **giganteus.** (*G. C.* 1897, xxii., 311.) Compositæ. H. A gigantic variety growing about 6 ft. high, the petioles being edible as in the Rhubarb. Japan.

Phaio-calanthe Imperator. (*G. C.* 1897, xxii., 315.) Orchideæ. S. A garden hybrid between *Phaius grandifolius* and *Calanthe Masuca.* (J. Veitch & Sons.)

***Philodendron imperiale laucheana,** Sander. (*G. C.* 1897, xxi., 352.) Aroideæ. S. A variety with ovate cordate leaves 6 in. to 9 in. long, bright green, heavily mottled with grey. (F. Sander & Co.)

Polygonatum moserianum. (*J. H. F.* 1897, 241.) Liliaceæ. H. A Solomon's seal with variegated leaves. (Moser, Versailles.)

Polypodium neriifolium cristatum. (*Vietch Cat.* 1897, 7 f.) Filices. G. Said to have been obtained by sowing spores of the type with spores of a crested variety of *P. vulgare.* The fronds are 3 to 4 ft. long, and the pinnæ are markedly crested or tasselled. (J. Veitch & Sons.)

Potentilla Friedrichseni, Späth Cat. 1897, 100. Rosaceæ. H. A garden hybrid between *P. dahurica* and *P. fruticosa.*

Primula cashmiriana alba. (*G. C.* 1897, xxii., 307.) Primulaceæ. H. A form with white flowers. (Haage & Schmidt.)

***Primula obconica fimbriata.** (*W. G.* 1897, 63, f. 14). G. A form differing from the type in having fringed corollas. (Vilmorin Andrieux & Co., Paris.)

***Primula obconica rosea.** (*G. M.* 1897, 172). G. A rose-coloured form. (T. S. Ware.)

Primula Traillii, Watt. (*G. C.* 1897, xxii., 263, f. 80; *Gard.* 1897, li., 465.) A species very closely allied to *P. involucrata.* Fls. blush, tinted white borne on tall slender scapes. Himalaya. (G. F. Wilson.)

Pycnanthemum pilosum, Nutt (*B. T. O.* 1897, 53, f. 9.) Labiatæ. H. A pleasantly pungent aromatic perennial with dense cymes of white flowers. N. America. (Dammann & Co., Naples.)

Pyrethrum starckianum, Alboff. (*Jard.* 1897, 378.) Compositæ. H. A greyish-tomentose alpine plant with cut leaves. Caucasus. (H. Correvon, Geneva.)

Pyrus occidentalis, S. Wats. (*G. and F.* 1897, 86, f. 11.) Rosaceæ. H. An alpine mountain ash. Washington, Oregon, &c. (Arnold Arboretum.)

Ranuculus Sommieri, Alboff. (*Jard.* 1897, 378.) H. A species with large, deeply-cut leaves and large bright yellow flowers. Caucasus. (H. Correvon, Geneva.)

Rhipsalis hadrosoma, G. A. Lindb. (*M. K.* 1897, 150, f.) Cacteæ. G. A species with cylindrical, light-green stems and white—almost transparent—flowers. Brazil. (G. A. Lindberg, Stockholm.)

Rhodanthe Manglesii sanguinea (*N. G. M.* 1897, t.) Compositæ. H. A form of this handsome everlasting with deep violet-red flower heads.

Rhododendron Harrisii (*G. C.* 1897, 418). Ericaceæ. H. A garden hybrid between *R. Thomsoni* and *R. arboreum.* (Lord Swansea.)

Rhododendron superbissimum (*G. and F.* 1897, 204; *G. C.* 1897, xxi., 290.) G. A garden hybrid between *R. Veitchii* and *R. Edgeworthii?* (J. Veitch & Sons.)

***Rhus trichocarpa,** Miq. (*G. and F.* 1897, 384, f. 49). Anacardiaceæ. H. A slender tree attaining a height of 25 ft., with long, unequally-pinnate leaves and narrow panicles of inconspicuous flowers followed by loosely drooping clusters of pale, prickly fruit. Japan. (Arnold Arboretum)

Rosa heterophylla (*J. H. F.* 1897, 777, f. 13). Rosaceæ. H. A garden hybrid, between *R. rugosa* and *R. lutea.* (M. Cochet-Cochet, France.)

***Russelia Lemoinei.** (*W. G.* 1897, 60.) Scrophularineæ. G. A garden hybrid between *R. juncea* and *R. sarmentosa.* (M. Lemoine, Nancy.)

***Salix gracilistyla,** Miquel. (*G. C.* 1897, xxii., 292.) Salicineæ. H. A handsome willow with bold, broadly-lanceolate, thickly-nerved leaves and crowded prominent buds. Catkins measure from 1½ in. to 3 in. in length. Japan, North China. (Barbier frères, Orleans.)

Sarracenia sanderiana. (*Sand. Cat.* 1897, 13.) Sarraceniaceæ. G. A garden hybrid between *S. Drummondi rubra* and *S. Farnhami.* (F. Sander & Co.)

***Scheelia kewensis,** Hook f. (*B. M.* tt. 7552, 3.) Palmeæ. S. A new species with pinnate leaves, 25 ft. long, and stout boat-shaped spathes, 2½ ft. long, from which the stout, short male and female spadices are developed; flowers small, crowded, and of a bright purple colour. Trop. America. (Kew.)

Selenipedium Duvali. (*S. H.* 1897, 229,) Orchideæ. A garden hybrid between *S. longifolium* and *S. lindleyanum.* (G. Mantin, Orleans.)

Senecio correvonianus, Alboff. (*Jard.* 1897, 378.) Compositæ. H. An alpine perennial with thick rhizome, long-stalked coriaceous reniform or cordate leaves, and a naked erect flower stem bearing a panicle of handsome yellow flowers. Caucasus. (H. Correvon, Geneva.)

***Sidalcea malvaeflora Listeri.** (*Gard.* 1897, lii., 51.) Malvaceæ. H. A variety with fringed pink flowers an inch and a half in diameter.

Sobralia macrantha alba-nana. (*G. C.* 1897, xxi. 294.) Orchideæ. G. A pure white variety with stems only a foot high. (F. Sander & Co.)

Solanum lasiophyllum, Dun. (*G. C.* 1897, xxii., 153.) Solanaceæ. G. A woolly spinous plant, a foot high, with whitish leaves and purple flowers. Western Australia. (S. Moore.)

Spathoglottis aureo-Veillardii. (*G. C.* 1897, xxi., 354.) Orchideæ. S. A garden hybrid between the species indicated by the name. (J. Veitch & Sons.

Spiraea arbuscula, Greene. (*G. and F.* 1897, 413, f. 53.) Rosaceæ. H. An alpine shrub with erect, wiry, branching stems, terminating in small compact corymbs of bright rose-red flowers. Washington, Oregon, &c. (Arnold Arboretum.)

***Stachys chrysantha,** Boiss. (*Gard.* 1897, lii., 208.) Labiatæ. H. H. A woolly leaved species, with lemon yellow-coloured flowers. Greece. (A. K. Bulley.)

Stapelia cupularis, N. E. Br. (*G. C.* 1897, xxii., 45.) Asclepiadeæ. G. A new species, resembling *S. variegata,* from which it is distinguished by its erect acute margin to the annulus. S. Africa. (N. E. Brown.)

Streptocarpus achimeniflora. (*G. M.* 1897, 296.) Gesneraceæ. G. A garden hybrid between *S. polyanthos* and a seedling of the *S. Rexi* strain. (J. Veitch & Sons.)

Streptocarpus gratus. (*W. G.* 1897, 280, f. 31.) G. A garden hybrid of which *S. Dunnii* is one of the parents. (J. Veitch & Sons.)

Streptocarpus pulchellus. (*Veitch Cat.* 1897, 8; *W. G.* 1897, 280, f. 33.) G. A garden hybrid of which *S. Fanninii* is one of the parents. (J. Veitch & Sons.)

***Strobilanthes callosus,** Nees. (*B. M.* t. 7538.) Acanthaceæ. S. An erect shrub 6 ft. high, freely branched, leaves 6 to 9 in. long, lanceolate, hairy; flowers large, pale violet-blue in short catkin-like spikes with green cucullate bracts. East Indies. (Kew.)

***Tainia penangiana,** Hook. f. (*B. M.* t. 7563.) Orchideæ. S. Pseudobulbs clustered, flagon-shaped, 2 in. long, purplish; leaves 1 ft. long, elliptic-lanceolate, plicate; scape 1 ft. high, bearing a few yellow and brown flowers, 2 in. across. Penang. (Kew.)

Tillandsia Dugesii, Baker. (*G. and F.* 1897, 44, f. 7.) Bromeliaceæ. S. Leaves glaucous with minute scales; peduncle shorter than leaves and closely sheathed by bracts, the bases of which are glossy and crimson; panicle a foot long; rachis crimson and glossy; corolla deep purple, half an inch longer than the calyx. Mountains of Santa Rosa, Central Mexico. (Harvard B. G.)

Tradescantia dilecta, L. Lind. (*Gfl.* 1897, 162.) Commelinaceæ. S. A species with cylindric green and dark purple blotched stalks; upper surface of leaves dark green with greenish-white stripes, under surface dark purple-violet. (L'Horticulture Internationale, Brussels.)

Trevoria Chloris, F. C. Lehm. (*G. C.* 1897, xxi., 345.) Orchideæ. S. A new genus, allied to *Stanhopea*. It has pear-shaped one-leaved pseudobulbs, broad leathery, plicate green leaves, and a pendant raceme of from twenty to thirty large fleshy green flowers with a white disc. Colombia. (Sir T. Lawrence.)

Trifolium polyphyllum, C. A. Mey. (*Jard.* 1897, 378.) Leguminoseæ. H. A species much like *T. alpinum* in habit but with several leaflets. Caucasus. (H. Correvon, Geneva.)

***Tulipa clusiana alba.** (*G. C.* 1897. xxi., 73, f. 20.) Liliaceæ. H. A white variety of the above species is here figured: segments with a pale purple spot at the base internally, and purple externally; anthers purplish. Chitral. (F. Sander & Co.)

***Tulipa pulchella,** Fenzl. (*G. C.* 1897, xxi., 35.) H. A dwarf early Tulip with rosy violet flowers. Asia Minor.

Utricularia forgetiana, Hort. (*Sand. Cat.* 1897. 18, f.; *Gard.* 1897, lii., 142 t. 1132.) Lentibulariæ. S. A form of *U. longifolia* with tall scapes of violet-blue flowers, each nearly 2 in. across. Brazil. It is called *U. latifolia* in "*The Garden.*" (F. Sander & Co.)

Vanda amoena, J. O'Brien. (*G. C.* 1897, xxii., 226, f. 69; *L.* 1897, t. 591.) Orchideæ. S. Supposed to be a natural hybrid between *V. cœrulea* and *V. Roxburghii*, but differing very little from the last named. (L'Horticulture Internationale, Brussels.)

Vanda coerulea peetersiana, Cogn. (*G. C.* 1897, xxii., 394.) S. A variety with large, white, rose-tinted flowers devoid of any blue shade. Khasia. (A. Peeters, Brussels.)

Vanda Moorei, Rolfe. *O. R.* 1897, 329.) S. A supposed natural hybrid between *V. kimballiana* and *V. cœrulea*. Burma. (J. W. Moore.)

Vanda suavis magnificens. (*L.* 1897, t. 587.) S. A form with larger and more brightly coloured flowers than the type. (L'Horticulture Internationale, Brussels.)

***Veronica balfouriana,** Hook. f. (*B. M.* t. 7556.) Scrophularineæ. H. A new species, allied to *V. Traversii*, but dwarfer, with smaller leaves which are margined with brown, and longer racemes of larger violet-coloured flowers. New Zealand. (Sir J. D. Hooker.)

***Vitis voinieriana.** (*G. and F.* 1897, 293.) Ampelideæ. S. A new species with thick fleshy scandent stems, alternate trifoliate fleshy leaves, the leaflets oblong obovate, 4 in. by 5 in., the margins serrate, the nerves prominent, glossy green above, hairy beneath. The fruit is said to be large, grape-like and of peculiar flavour. China. (J. Sallier, Paris.)

Vriesia furcata. (*J. H. F.* 1897, 241.) Bromeliaceæ. S. A garden hybrid, parentage not stated. (Devansaye Noyant, France.)

Vriesia hybrida sanderiana. (*Gfl.* 1897, 177, f. 51.) S. A garden hybrid between *V. guttata* and *V. wittmackiana*. (Kittel, Eckersdorf, Silesia.)

Zephyranthes Ajax. (*W. G.* 1897, 14.) Amaryllideæ. G. A garden hybrid between *Z. candida* and *Z. citrina*. (Dammann & Co., Naples.)

Zephyranthes coerulea, Baker. (*W. G.* 1897, 15.) G. A small-flowered species with pale-blue or lilac flowers. Uruguay. (Dammann & Co., Naples.)

Zygopetalum Perrenondii euper tium. (*G. C.* 1897, xxi., 261.) Orchideæ. S. A garden hybrid between *Z. Gautieri* and *Z. intermedia*. (J. Veitch & Sons.)

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX III.—1898.

LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India and the Colonies, in Correspondence with Kew.

* Trained at Kew. † Recommended by Kew.

Royal Gardens, Kew :—

Director - - - - -	W. T. Thiselton-Dyer, C.M.G., C.I.E., F.R.S., LL.D., Ph.D., M.A., F.L.S.
Private Secretary - - -	Stephen T. Dunn, B.A., F.L.S.
Assistant (Office) - - -	*John Aikman.
,, ,, - - - -	*William Nicholls Winn.

Keeper of Herbarium and Library	John Gilbert Baker, F.R.S., F.L.S.
Principal Assistant (Phanerogams)	*William Botting Hemsley, F.R.S., F.L.S.
,, ,, (Cryptogams) -	George Massee, F.L.S.
Assistant (Herbarium) - -	Nicholas Edward Brown, A.L.S.
,, ,, - -	*Robert Allen Rolfe, A.L.S.
,, ,, - -	Charles Henry Wright, A.L.S.
,, ,, - -	*Sidney Alfred Skan.
,, ,, (Temporary)	I. H. Burkill, M.A., F.L.S.
,, for India - - -	Otto Stapf, Ph.D., A.L.S.

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Honorary Keeper, Jodrell Laboratory	Dukinfield Henry Scott, F.R.S., M.A., Ph.D., F.L.S.

Keeper of Museums	John Reader Jackson, A.L.S.
Assistant (Museums)	John Masters Hillier.
Preparer	George Badderly.

Curator of the Gardens	George Nicholson, F.L.S.
Assistant Curator	William Watson.
Foremen :—	
Arboretum	*William J. Bean.
Herbaceous Department	*Walter Irving.
Greenhouse and Ornamental Department.	Frank Garrett.
Temperate House (Sub-tropical Department).	*William Dallimore.

Cambridge.—University Botanic Garden :—

Professor	Henry Marshall Ward, M.A., Sc.D., F.R.S., F.L.S.
Secretary to Botanic Garden Syndicate	A. C. Seward, M.A., F.R.S.
Curator	*Richard Irwin Lynch, A.L.S.

Dublin.—Royal Botanic Gardens, Glasnevin :—

Keeper	Frederick W. Moore, A.L.S.

Trinity College Botanic Gardens :—

Professor	E. Perceval Wright, M.D., F.L.S., Sec. R.I.A.
Curator	*F. W. Burbidge, M.A., F.L.S.

Edinburgh.—Royal Botanic Garden :—

Regius Keeper	Isaac Bayley Balfour, M.D., D.Sc., F.R.S., F.L.S.
Head Gardener	A. D. Richardson.
Assistant Gardener	*R. L. Harrow.

Glasgow.—Botanic Gardens :—

University Professor	F. O. Bower, D.Sc., F.R.S., F L.S.
Curator	*Daniel Dewar.

Oxford.—University Botanic Garden :—

Professor	SydneyH.Vines,D.Sc., F.R.S., F.L.S.
Curator	*William Baker.

COLONIES.

Antigua.—Botanic Station :—

	Acting Curator - -	Alleyne S. Archer.

Barbados.—Dodd's Reformatory, Botanic Station :—

	Superintendent -	John R. Bovell, F.C.S., F.L.S.

Bermuda.—Botanic Station :—

	Superintendent -	†G. A. Bishop.

British Central Africa.—Scientific Department :—

Zomba - -	Head of Department -	J. McClounie.
	Government Botanist	*John Mahon

British Guiana.—Botanic Gardens :—

Georgetown -	Superintendent and Government Botanist.	*George S. Jenman, F.L.S.
	Head Gardener -	†John F. Waby.
	Second ,,	*Robert Ward.
	Promenade Garden :—	
	Head Gardener -	William Jackson.
Berbice - -	Keeper - - -	Richard Hunt.

British Honduras.—Botanic Station :—

	Curator - - -	Eugene Campbell.

Canada.—

Ottawa - -	Dominion Botanist -	Prof. John Macoun, M.A., F.R.S.C., F.L.S.
	Assistant ,, -	Jas. M. Macoun.
	Director of Government Experimental Farms.	Prof. Wm. Saunders, F.R.S.C., F.L.S.
	Director's Assistant and Superintendent of Botanic Garden.	W. T. Macoun.
	Botanist and Entomologist.	James Fletcher, F.L.S.
Montreal - -	Director, University Botanic Garden.	Prof. D. P. Penhallow, B.Sc.

Cape Colony.—

	Government Botanist	Prof. MacOwan, F.L S.

Ceylon.—Department of Royal Botanic Gardens :—

	Director - - -	†John C. Willis, M.A., F.L.S.
Peradeniya -	Curator - - -	*Hugh McMillan.
	Clerk - - -	J. Ferdinandus.
	Draughtsman - -	W. de Alwis
Hakgala - -	Superintendent - -	*William Nock.
	Clerk and Foreman -	M. G. Perera.

Henaratgoda -	Conductor - -	S. de Silva, Arachchi.
Anuràdhapura	„ - - -	D. F. de Silva.
Badulla - -	„ - - -	D. A. Guneratne.

Dominica.—Botanic Station :—

	Curator - - -	*Joseph Jones.
	Agricultural Instructor.	*David Tannock.

East Africa Protectorate.—Botanic Garden :—

Uganda	Curator - - -	†Alexander Whyte, M.A., F.L.S.

Falkland Islands.—Government House Garden :—

	Head Gardener - -	*Albert Linney.

Fiji.—Botanic Station :—

	Curator - - -	*Daniel Yeoward.

Gambia.—Botanic Station :—

	Curator - - -	———

Gold Coast.—Botanic Station :—

	Curator - - -	*William H. Johnson.

Grenada.—Botanic Garden :—

	Curator - - -	*Walter E. Broadway.

Hong Kong.—Botanic and Afforestation Department :—

	Superintendent - -	†Charles Ford, F.L.S.
	Assistant Superintendent	*W. J. Tutcher.

Jamaica.—Department of Public Gardens and Plantations :—

	Director - - -	†William Fawcett, B.Sc., F.L.S.
Hope Gardens -	Superintendent - -	*William Cradwick.
Castleton Garden	„ -	*William J. Thompson.
Cinchona (Hill Garden).	„ -	*William Harris.
Kingston Parade Garden.	„ -	John Campbell.
King's House Garden.	„ -	*Thomas J. Harris.
Bath - - -	Overseer - - -	A. H. Groves.

Lagos.—Botanic Station :—

	Curator - - -	———
	Assistant - - -	*F. G. R. Leigh.
	„ - - -	*T. B. Dawodu.

Malta—Argotti Botanic Garden :—

	Director - - -	Dr. Francesco Debono.

Mauritius.—Department of Forests and Botanic Gardens :—

Pamplemousses -	Director - - -	J. Vankeirsbilck.
	1st Assistant - -	Paul Koenig.
	2nd „ - - -	S. E. Pougnet.

Overseer - - - J. Powell.
Curepipe - - Overseer - - - F. Bijoux.
Reduit - - „ - - - W. A. Kennedy.

Montserrat.—Botanic Station :—
Curator - - - ———

Natal.—Botanic Gardens :—
Durban - - Curator - - - John Medley Wood, A.L.S.
Head Gardener - - *James Wylie.
Propagator - - *William Thorpe.
Pietermaritzburg Curator - - - G. Mitchell.

New South Wales.—Botanic Gardens :—
Sydney - - Director - - - J. H. Maiden, F.L.S.
Technological Museum :—
Curator - - - R. T. Baker, F.L.S.

New Zealand :—
Wellington.—Colonial Botanic Garden :—
Head Gardener - - G. Gibb.
Dunedin - - Superintendent - - J. McBean.
Napier - - „ - - W. Barton.
Invercargill - Head Gardener - - Thomas Waugh.
Auckland - - Ranger - - - William Goldie.
Christchurch - Head Gardener - - *Ambrose Taylor.

Niger Coast Protectorate.—Botanic Garden :—
Old Calabar - Curator - - - *John H. Holland.
Assistant Curator - *Harold B. Lloyd.

Perak (Taiping).—Government Gardens and Plantations :—
Superintendent - - *Robert Derry.

Queensland.—Botanic Department :—
Brisbane - - Colonial Botanist - F. M. Bailey, F.L.S.
Botanic Gardens :—
Curator - - - *Philip MacMahon.
Overseer - - - J. Tobin.
Acclimatisation Society's Gardens :—
Secretary and Manager Edward Grimley.
Overseer - - - James Mitchell.
Rockhampton - Superintendent - - J. S. Edgar.

St. Kitts-Nevis.—Botanic Station :—
Curator - - - *William Lunt.

St. Lucia.—Botanic Station :—
Curator - - - *John Chisnall Moore.

St. Vincent.—Botanic Station :—
Curator - - - *Henry Powell.

Sierra Leone.—Botanic Station :—
Curator - - - *Walter Haydon.

South Australia.—Botanic Gardens :—

Adelaide	Director	Maurice Holtze, F.L.S.
Port Darwin	Curator	Nicholas Holtze.

Straits Settlements.—Gardens and Forest Department :—

Singapore	Director	†H. N. Ridley, M.A., F.L.S.
	Assistant Superintendent.	*Walter Fox.
Penang	Assistant Superintendent.	†Charles Curtis, F.L.S.

Tasmania.—Botanic Gardens :—

Hobart Town	Superintendent	F. Abbott.

Tobago.—Botanic Station :—

	Curator	*Henry Millen.

Trinidad.—Royal Botanic Gardens :—

	Superintendent	†John H. Hart, F.L.S.
	Assistant „	———

Victoria.—Botanic Gardens :—

Melbourne	Curator	W. R. Guilfoyle.
National Herbarium :—		
	Curator	J. G. Luehmann, F.L.S.

West Indies.—Imperial Department of Agriculture :—

Barbados	Commissioner	D. Morris, C.M.G., D.Sc., M.A., F.L.S.
	Travelling Superintendent.	———
	Secretary	Walter Farrell.

Western Australia.—Department of Agriculture :—

Perth	Botanist	Alexander Morrison.
	Consulting Botanist	F. Turner, F.L.S. (Sydney).

Zanzibar.—

	Director of Agriculture.	R. N. Lyne.

INDIA.

Botanical Survey.—Director, Surgeon Major D. Prain, M.B., F.L.S., F.R.S.E.

Bengal, Assam, Burma ; the Andamans and Nicobars ; North-East Frontier Expeditions :—

Superintendent of the Royal Botanic Gardens, Calcutta	Surgeon-Major D. Prain, M.B., F.L.S., F.R.S.E

Bombay, including Sind :—

Professor of Botany, College of Science, Poona -	*G. Marshall Woodrow.

Madras: the State of Hyderabad and the State of Mysore :—

Government Botanist -	†C. A. Barber, M.A., F.L.S.

North-Western Provinces and Oudh ; the Punjab ; the Central Provinces ; Central India ; Rajputana ; North-West Frontier Expeditions :—

Director of the Botanic Department, Northern India, Saharanpur, N.W.P. - -	†J. F. Duthie, B.A., F.L.S.

Bengal :—

Reporter on Economic Products to the Government of India, Indian Museum, Calcutta	George Watt, M.B., C.M., C.I.E., F.L.S.

Bengal.—Department of Royal Botanic Gardens :—

Calcutta (Seebpore)	Superintendent -	Surgeon-Major D. Prain, M.B., F.L.S., F.R.S.E.
	Curator of Herbarium - -	Surgeon-Lieutenant Gage.
	Curator of Garden -	*G. T. Lane.
	Assistant „ -	*George H. Cave.
	Probationer -	*Albert E. P. Griessen.

Calcutta.—Agri-Horticultural Society of India :—

	Secretary - -	P. Lancaster.
Mungpoo -	Superintendent, Government Cinchona Plantations	Surgeon-Major D. Prain, M.B., F.L.S., F.R.S.E.
	Deputy „ -	*R. Pantling.
	1st Assistant -	*Joseph Parkes.
	2nd „ -	G. A. Gammie.
	3rd „ -	*Amos Hartless.
	4th „ -	*Oliver T. Hemsley.

Darjeeling.—Lloyd Botanic Garden :—

Curator - - - -	*William A. Kennedy.

Darbhangah.—Maharajah's Garden :—

Superintendent -	Herbert Thorn.

Bombay.—

Poona - -	———	———
	Professor of Botany	*G. Marshall Woodrow.

Ghorpuri.—Botanic Garden :—

	Superintendent -	P. G. Kanitkar.

Bombay.—Municipal Garden :—

	Superintendent -	C. D. Mahaluxmivala.

Karachi.—Municipal Garden :—

	Superintendent -	*William Strachan.

Central Provinces.—

Nagpur - -	Superintendent of Public Gardens.	*J. Horne Stephen.

Madras.—Botanic Department :—

Ootacumund -	Government Botanist	†C. A. Barber, M.A., F.L.S.
	Director of Government Cinchona Plantations.	W. M. Standen.
	Curator of Gardens and Parks.	*Robert L. Proudlock.

Madras.—Agri-Horticultural Society :—

	Hon. Secretary - -	Dr. A. G. Bourne.
	Superintendent -	*J. M. Gleeson.

Native States.—

Mysore (Bangalore)	Superintendent -	*J. Cameron, F.L.S.
Baroda - -	„ -	*G. H. Krumbiegel.
Gwalior - -	„ -	†C. Maries, F.L.S.
Morvi - - -	„ -	*Joseph Beck.
Travancore (Trivandrum)	„ -	———
Udaipur - -	„ -	T. H. Storey.

North-West Provinces—

Agra (Taj Garden)	Superintendent -	F. J. Bullen.
Allahabad - -	„ -	*H. J. Davies.
Cawnpur - -	„ -	G. H. T. Mayer.
Kumaon (Ramghur)	„ -	*F. W. Seers.
Lucknow - -	„ -	*Matthew Ridley.
Saharanpur and Branch Garden, Mussoorie.	„ -	William Gollan.

Punjab.—

Lahore - -	Superintendent -	H. G. Hein.